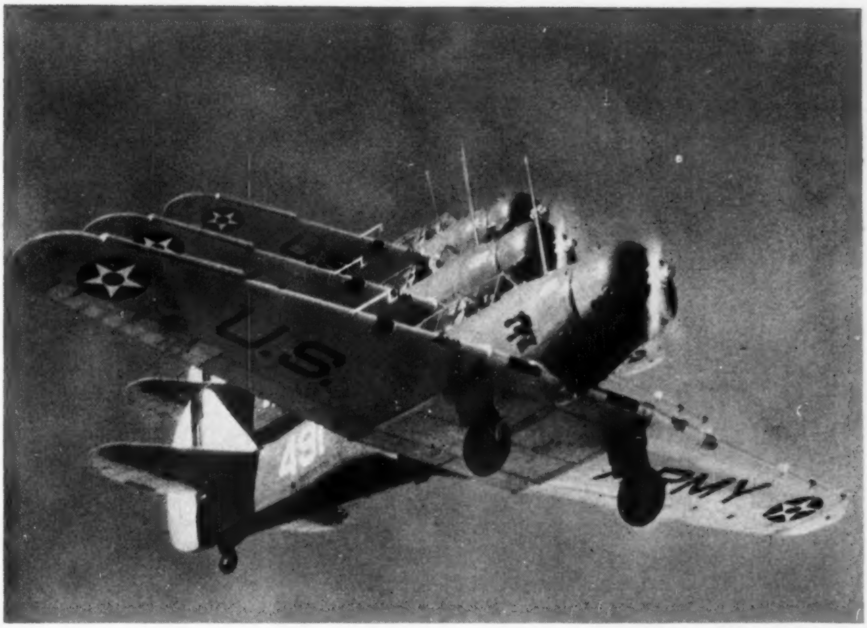
The Science Teacher



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The Science Teacher

Official Journal of

American Council of Science Teachers

A department of the National Education Association

American Science Teachers Association

Associated with American Association for Advancement of Science

And State and Regional Associations

The Officers of the

AMERICAN COUNCIL OF SCIENCE TEACHERS

Association directors will be announced in a later issue of this journal. Science teachers' associations are invited to affiliate with the American Council of Science Teachers. For information, write to any officer.

Officers and Directors

AMERICAN SCIENCE TEACHERS ASSOCIATION

Science teachers' organizations are invited to affiliate with the American Science Teachers Association. For information write to any officer.

THE TENTH ANNUAL meeting of the American Science Teachers Association will be held in New York City, December 28, 1942.

The Science Teacher

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A Service Journal for National, State, and Regional Associations

Official Journal of

ILLINOIS ASSOCIATION OF CHEMISTRY TEACHERS
ILLINOIS BIOLOGY TEACHERS ASSN.
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The Metals as Vital War Materials

B. S. HOPKINS

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THE WAR in which this world is now engaged has shown itself to be a titanic struggle of armed forces, of mechanical equipment, of essential supplies and of scientific skill both in offense and defense. Victory will come to those who command the greatest supplies of man power and effective training; to those whose reserves of necessary materials can be made to meet the vital needs of both military and civilian groups; and to those whose courage and determination in the defense of high principles and lofty ideals can best survive adversity and press on and on in the face of discouragement.

One of the outstanding facts which is quite evident in the present struggle is the great importance of metals as raw materials. Essentially all of the metals which we commonly use are now eagerly sought by the warring nations and the sources of supply are carefully guarded in order that these materials may be available in ever increasing supplies. These metals are neecssary for equipment for the soldier, for munitions, for transportation, for protection, for processing and preserving foods, for the production of power, for maintaining public health and for an innumerable list of every day uses with which we are all familiar. If the supply of metals fails, then the whole structure of existence, both military and civilian, is rudely disturbed. If the supply of any one of the vital metals fails to meet our national need, there follows immediately a critical situation which quickly becomes serious. If the demand cannot be met promptly or if a suitable substitute cannot be provided then the whole national plan may be disrupted and disaster will follow as an inevitable consequence.

AS AN EXAMPLE of the critical condition which may develop because of the lack of a certain metal, we may cite the case of cobalt. This is a metal, closely resembling nickel, which under ordinary circumstances is quite insignificant in the world's commerce. One use for the metal which seemed particularly insignificant was its employment as a binder in the manufacture of super-hard grinding tools of the ramet type. When the war broke out we suddenly discovered that our supply came largely from ore which was mined in the Belgian Congo and refined in Belgium; that the cutting off of this supply meant that ramet cutting tools could no longer be manufactured; that without an adequate supply of cutting and grinding equipment the process of manufacturing machine tools was greatly hampered; that without suitable tools the machinist could not produce the equipment needed so sorely and in such vastly increased amounts in the suddenly expanding program of national defense. So our safety as a nation was threatened and "all for the want of a horse-shoe nail" in the form of a few pounds of the no-longer-insignificant metal cobalt.

The essential nature of all the useful metals has made it necessary to limit their employment in all ways except the essential industries. So priorities have been established on practically all metals except gold and silver. By one of those strange economic freaks which are produced by the sudden advent of war, it is now almost literally true that the

only metals which we are permitted to use without priority limitation are the so-called "precious" metals gold and silver. It is surprising too to learn that these metals, especially silver, are rapidly finding commercial uses which were undreamed-of a few years ago.

THE DEMAND for all metals has increased at a tremendous rate because of the sudden and enormous increase in our need. For this reason we civilians are asked to save every bit of metal scrap. Even though we are able to save only small quantities, every little helps and if everybody does their best the combined effort will produce surprising totals. These salvaged supplies have a threefold value for these reasons: (1) the tonnage adds materially to our total supply; (2) these supplies of secondary metals permit our regular producers to get caught up somewhat upon their orders; (3) most of the recovered metals are in a form which permits their immediate re-use, thus saving the time and expense necessary in the refining of new metals.

The United States has been for many years the most favored nation in the world from the stand point of its mineral resources. From the most recent available data it appears that we have ranked first as a producing nation in iron, copper, zinc and lead; we have been second in aluminum and third in the production of magnesium and mercury. These are all metals of prime importance in military operations and nations whose supplies of these metals are limited are definitely handicapped in the promotion of war-time activities. Our own ability to produce leading quantities of these metals, and to increase enormously the tonnage of each, contributes largely to the potential fighting power of the nation. Let us consider briefly our mineral resources with respect to each of these strategic metals.

IRON IS THE most important metal that we know either in civilian or military life. Its production is ten times that of all the other metals put together. Some students of human affairs have stated that, if civilization were deprived of the use of iron, the loss would be greater than if all the other metals were suddenly to be removed from our earth. Iron has been of particular importance to military activities throughout the centuries. The alchemists dedicated the metal iron to Mars the god of war and used an arrow as the symbol for the element. The mechanization of modern armies has greatly increased the importance of iron and now adequate supplies of this metal are absolutely essential, since substitutes are quite impossible.

The United States has produced about 40 per cent of the world's iron and steel. Germany has ranked second producing about 18%. The United Nations regularly produce nearly two-thirds of the world's iron and this fact in itself shows a distinct advantage in a long war. Perhaps one of Japan's most obvious weaknesses is the fact that they have produced only about 4% of the world's iron. This in itself is a clear indication that their own resources may be exhausted quickly in the present struggle.

COPPER is another vital metal for military operations, since there is no adequate substitute for brass and since copper is so universally used for electric wiring and in all electrical equipment. The United States produces 31% of the world's copper in normal times and is capable of great expansion in its production.

During the years 1915-20 the United States produced over 60% of the world's zinc but our contribution has gradually declined until in 1938 we supplied about 28% of all the zinc which was mined. We are still the leading producer; Germany which ranks second produces less than half as much zinc as is mined in the United States.

Long after other useful metals were put upon the priority list it was thought that there was an abundance of lead. But the shortage of any metal in our normal list puts an added burden on other metals and as a result of the greatly increased demand for lead there arose an acute shortage in the supply of this metal.

IN THE FIELD of the light metals aluminum and magnesium we do not occupy quite such a favorable position since Germany has been the leading producer in both. Up to the

outbreak of the present war Germany has produced half of the world's magnesium and nearly a third of the aluminum. We have been a close second in the production of aluminum, supplying 24%, but our production of magnesium has been third in rank, supplying only about 14% of the world's supply. These two light metals are vitally important in building airplanes and speed boats, and so the war has greatly stimulated the production of both metals.

There has been great confusion in the public mind regarding the production of aluminum and it is by no means certain that any brief summary can present a fair picture of the situation. Aluminum has been produced from the single ore bauxite. The U. S. supply comes chiefly from Arkansas, some being produced in Alabama and Georgia. From 1915-20 the United States produced 60-70% of the world's bauxite; although our tonnage since 1920 has not decreased materially, our relative position as a producer of bauxite has fallen from first position to sixth — we now produce only about 9% of the world's bauxite. This fact indicates clearly that the world's race for air supremacy has greatly stimulated the production of aluminum wherever deposits of bauxite are known to exist. In 1939 our domestic sources supplied about 45% of our total consumption, the remainder being imported, mainly from Dutch and British Guiana. These vital supplies of aluminum ore in South America explain very nicely why the United States Marines are guarding the Guianas. The expansion of our facilities for the production and fabrication is one of the big achievements in these hectic days. Alcoa alone has announced an expenditure of $206,000,000 from 1938-41; in addition there are three new government-owned smelters and two fabrication plants. These enlargements have been called a "20-year job which is to be completed in 8 months." This will give us a capacity 38% of our prewar production. With added volume has come decreased cost; aluminum pig is now selling for 15 cents a pound, the lowest price in the history of the industry. With still mounting demands for more and more metal, attention is being directed to other ores of aluminum and it is quite within the range of possibilities that before the present emergency is passed we may have efficient methods of extracting the metal from other ores and the reign of King Bauxite will be over.

THE COMPOUNDS of magnesium have long been familiar because of their varied uses, but only recently has the metal attracted attention. Now because of its lightness and the strength and workability of its alloys, magnesium has taken a prominent place as a metal of strategic importance in national defense. The Dow Chemical Company, of Midland, Michigan, has been the only American producer of magnesium. The metal has been obtained by electrolysis of magnesium chloride, which is obtanied from deep-well brines. The same company has recently put into production a $5,000,000 plant at Freeport, Texas, which extracts magnesium chloride from sea water. Another new plant in Louisiana is also to use $Mg\ Cl_2$. On the Pacific coast serious efforts have been made to extract magnesium from other sources. Magnesite, dolomite, and brucite are fairly abundant and methods have been proposed for extracting the metal from each. The total capacity of the plants now in operation or building is said to be approximately 150,000 tons of metal per year. This is thirty times our maximum capacity in 1939.

MERCURY is another metal whose uses are varied and indespensable. During the period 1935-39 the United States used an average of over 2,000,000 lbs per year in the manufacture of drugs, dental amalgams, storage batteries, barometers, thermometers, mercury vapor lamps and felt hats. In war time an important use is the manufacture of detonators for high explosive shells. Most of our supply in the past has come from Spain and Italy, but fortunately California and Oregon have numerous small deposits, which can be worked intensively when foreign supplies fail. In 1937 our domestic supply furnished mercury for 46% of our needs; in the following year our own mines supplied 88% of the national demand. So the supply of mercury is adequate if proper economy is exercised.

Editorial and News

Working With a Science Group?

ARE you working with an organized group in the war effort? Are you doing your bit through your state or regional science association? As a group, and as individuals, we need to feel our responsibility of working together as never before to meet our country's need, and especially so since the emergency is one made grave by the abuse of science and must be met with science intelligently applied. The responsibility rests upon us, as science teachers, to produce well trained individuals. It is group work that counts.

This is a year when association work may be most helpful, giving inspiration to the average teacher to improve his course and make it more effective. It also will help in spreading ideas as to how preparation for active military or civilian service can best be accomplished in our classes. Most of us have the energy and the will to work, but we need more ideas, more leadership, more plans. With these, the science teachers' associations will help.

SOME of our association leaders may be discouraged and feel that science groups should discontinue for the duration. But this is a serious error. It is true that meetings may be curtailed somewhat due to the necessity of conserving rubber and transportation facilities. But the association can forge ahead in the most needed work. Members who cannot be present in meetings can maintain their contact through the news letters of the association and its official journal and can keep informed on what is being done. Other teachers who have never been active, may become members, even if not in attendance. Many already are joining. Those who are genuinely interested in the welfare of their students and their nation's needs, as well as their own professional advancement, will do so. Now is no time to relax.

The kind of spirit that wins is typified by that of General Foche in World War I. When things looked the blackest for his army, he said, "My front has been pierced, my flank turned, and rear threatened. Attack!" This is the spirit for all of us, including our present association leaders. Let us attack — attack the problem of producing results through more functional courses suited to present needs.

WE are now finding the spirit of "doing" in increasing evidence. Just recently I have received messages from a number of state and national association leaders indicating a will to push ahead. From Miss Greta Oppe of the Texas Science Teachers Association and from Mr. J. P. Finfrock, its president, come a pointed statement as to our need for progress. Somewhat similar notes come from Mr. A. L. McLendon, president of the Georgia Association, from Dr. R. W. Horrabin, president of the Illinois Association of Chemistry Teachers, from Mr. William Katz of the National Asociation of Biology Teachers, and from several other leaders. We must help to maintain this wholesome spirit. The least we can do is to add our encouragement *openly and actively*.

WORKING with our local or state association does not end our obligaiton. We must look ahead to the national associations, their work, and the help they offer. Isolationism in terms of teacher groups definitely retards and even blocks possible progress. There is nothing to lose through a national affiliation. Local control, initiative and prestige are still maintained. At the same time the stimulus of national contact, greater access to useful ideas, and the possibility of greater and more rapid professional growth are all factors that weigh heavily in the direction of national cooperation.

But the individual teacher need not wait for his local group to affiliate with a national organization in order to secure many of its advantages. He can become a direct member and should do so. Then he can cooperate in all plans that are being carried out. He can

have a stimulating contact. He can develop professionally as a more useful science teacher.

Both the American Science Teachers Association and the American Council of the National Educaitonal Association are in need of direct members and workers. You will note the article in this issue by Dr. Philip Johnson of Cornell University, president of the American Council, in a clear cut statemen tof the work of this group. The association is active and is forging ahead vigorously *now.* The same statement may be made for the American Council in a clear cut statement of the leadership of Dr. Morris Meister of the Bronx High School of New York City. The December program of the association listed elsewhere in this issue speaks for the direction in which this group is actively moving. You can well afford, as a science teacher, to belong to each of these groups, as well as your state or regional association, considering the services rendered. The cost is small and the returns satisfying.

NATIONAL ASSOCIATION OF BIOLOGY TEACHERS

THE National Association of Biology Teachers will hold a meeting in Detroit, October 10, 1942, at the Book-Cadillac Hotel. The sessions will be based on Biology and Defense and on Biology and Conservation. Among the speakers will be Dr. E. Lawrence Palmer of Cornell University, Dr. Max Peet of the University of Michigan Hospital, Dr. Paul Krone of Michigan State College, Dr. Loren W. Shaffer of the Detroit Board of Health, Mr. Walter Hastings of the Michigan Department of Conservation and Mr. Howard Michaud of the Indiana Department of Conservation. Further information may be obtained by writing to the chairman, Miss Betty Lockwood, 18420 Wisconsin Avenue, Detroit, Michigan.

OUR FRONTISPIECE

Through the courtesy of the United States Department of War we are presenting an unusual picture on the cover, a picture illustrating precision flying of army air craft. This was supplied to us by Mr. Bert Shields along with the article on "Aeronautics in the High School Curriculum" which appears in this issue. Mr. Shields is an ace pilot and teacher and is also a Lieutenant Commander in the United States Naval Reserve.

American Science Teachers Association Announces Convention in New York

THE 1942 convention of the American Science Teachers Association will be held in New York City December 29 and 30. Arrangements have been completed for the use of Hotel Pennsylvania and the program will be given there. Dr. Hugh C. Muldoon, first vice president of the association and editor of *The Science Counselor,* is in charge of the program. Dr. Morris Meister of the Bronx High School of Science, New York City, is president of the association.

The program centers about two vital problems of the present. One session deals with "Science Teaching in War Time" and another with "Curricular Problems" as related to science instruction. For the complete program see a later page of this issue.

The usual noon-hour luncheon is scheduled, with Dr. Otis W. Caldwell, general secretary of the American Association for the Advancement of Science, presiding. As usual, the president of the A. A. A. S. will speak at the luncheon; and this year the president and speaker is Dr. Arthur H. Compton of the Massachusetts Institute of Technology.

All science teachers are cordially invited to attend the meeting, whether members of the association or not. A membership may be obtained by sending the nominal yearly fee of $1.00 to the treasurer, Mr. Leo J. Fitzpatrick, Brockton High School, Brockton, Massachusetts. The fee includes a one year's subscription to the Science Teacher, the official publication of the association.

In keeping with its plan of cooperation with other associations, the American Science Teachers Association will also hold joint meetings with several other science associations December 28 and 29.

What Is the American Council of Science Teachers?

PHILIP G. JOHNSON, President
THE AMERICAN COUNCIL OF SCIENCE TEACHERS
Cornell University **Ithaca, New York**

Because of many requests for information concerning the American Council of Science Teachers and also because of a need for accurate information as to its nature and purposes, we have asked Dr. Philip G. Johnson, president of the association, for the exact statement about it that is here given. This we believe will aid organized groups, as well as individuals, that are now considering active cooperation with the Council.—Editor.

SINCE the organization of the American Council of Science Teachers, there has been much interest in the association and its work. There have been many requests for information about it by individuals and groups. There also has been, in a few instances, among those who have not been accurately informed, some confusion as to its nature and purposes. To meet the need for accurate information as a basis for judging the merits of the association, and to prevent any confusion, it seems appropriate to summarize the nature, purposes, and plans of the organization. It also seems appropriate to make clear to classroom science teachers a new avenue of service to them. The statements which follow have been prepared to reveal the more essential features of the American Council of Science Teachers.

Essential Features of the Council

1. The American Council of Science Teachers is a department of the National Education Association and supersedes the former Department of Science Instruction. It is not a new organization. It is a reorganization of the Department of Science Instruction.
2. It is an outgrowth of the National Committee on Science Teaching and the related sub-committees which the National Education Association and the Department of Science Instruction have sponsored for several years. The National Committee on Science Teaching proposed the development of a National Council to the Department at the Milwaukee meeting in 1940. The officers of the Department considered the proposal and drafted a constitution as an interpretation of the plan. The proposal and the constitution were brought before the Department and the National Committee on Science Teaching was encouraged to study the proposed constitution and continue the making of plans for a National Council.
3. It is organized to carry forward the work of the National Council on Science Teaching and the work of its related sub-committees. Three reports have been published and released; *Science Teaching for Better Living* — A Philosophy or Point of View. *The Education of the Science Teacher, Redirecting Science Teaching in the Light of Personal-Social Needs.* The distribution and use of these reports are being encouraged by the Department. A fourth report is approaching its final form and some expenses incident to its criticisms are being paid by the Department. It is planned that this and other reports will be released in the name of The American Council of Science Teachers, a Department of the National Education Association.
4. The American Council of Science Teachers seeks to encourage the active cooperation of all organizations of science teachers in the study and solution of major science education problems. The National Committee on Science Teaching consisted of seventeen science leaders representing ten organizations of science teachers. There were more than a hundred consultants who by their membership represented almost all the organizations of science teachers in the United States. The Department as re-organized seeks to make this type of cooperative work continuous and to extend it to other groups of science teachers. All organizations of science teachers are invited to appoint or select one or more of its

members to help continue and expand the projects initiated by the National Committee on Science Teaching and its related sub-committees. There is no fee to be paid for the privilege of such representation and most of the business will be conducted by mail thus making possible the active cooperation of all representatives.

5. There will be financial assistance to cooperating groups. Each membership received through the cooperation of an affiliated organization designated by the member, will bring about a rebate of a portion of the membership fee to the cooperating organization. The rebate increases in amount at a rate greater than the rate of increase for memberships. As an example, $25.00 will be rebated to an affiliated organization which is credited with 100 memberships. By cooperating in membership and other activities your own organization is benefited in a direct way as well as in other indirect ways.

6. There will be several services which are free to all members. The official magazine will be mailed to each member four times during the school year. The Yearbook with papers and reports from the annual summer meeting together with other timely papers, will be mailed to each member early in the fall. The program for the annual meeting and a list of new books of interest to science teachers will be mailed to members in the spring. A program which presents outstanding science leaders and teachers will be arranged and presented for all members who are present at the annual summer meeting.

7. There are only two classes of members; Active and Supporting. You can become an Active member upon the payment of the anuual dues of $1.00. The supporting membership fee is $5.00. All persons who become members before January 1, 1943 will be considered to be charter members of the Department as re-organized.

8. The officers of The American Council of Science Teachers are eager to enlist you as a member and your organization of science teachers as an affiliate. Many plans and policies remain to be determined and the help of your representative is most earnestly desired.

9. The American Council of Science Teachers needs your personal help. You can help by making suggestions and criticizing plans. You can prepare papers for the magazine and the Yearbook. You can help in the preparation of special service bulletins as a committee member or as a consultant. You can support the activities of the Council with your membership. You can stimulate others to become members. You can encourage your organization of science teachers to select a representative to the Council and through your representative help to define and implement the policies of the Council.

10. The American Council of Science Teachers has been organized to help you and your co-workers to render more effective services as classroom science teachers. If you are now active in an organization of science teachers, you may be assured that the primary desire of the Council is to help your organization in making its services more effective. If there is no active organization of science teachers in your area, the Council desires to help you establish or re-organize an organization. Travel to attend meetings may be curtailed for the duration, but essential services must go on and these can be rendered by mail. Perfecting your organization now will make possible the most effective service for the duration and for the post-war period.

NEVER IN OUR lifetime of science teaching have science teachers and their efforts been so crucially challenged. Never have there been such opportunities for science teachers to serve their country both directly and indirectly through the students they train and through their own direct activities in some

(Continued on page thirty-four)

Aviation in the High School Curriculum

BERT SHIELDS

Polytechnic Institute of Brooklyn **Brooklyn, New York**

THE HOBBY HORSE has grown wings and become a Pegasus aiding the war effort. The boys who played with model airplanes are flying today's bombers; meanwhile the need for pilots continues to increase.

The United States has sent out a call for an additional 375,000 trained pilots by June, 1943. A gigantic training program is already under way, with every Army and Navy training center crowded to capacity. Private schools are turning out air cadets under government contract, and the Civilian Pilot Training division of the Civil Aeronautics Administration has been training approximately 45,000 pilots a year. In all of these programs precious weeks are spent in teaching high school subjects and basic aviation that the students should have learned in high school. If America's educators are to contribute effective support to the victory effort, they must provide students with pre-flight aviation training. If such courses are properly planned, the future flying cadets will be relieved of many hours' ground school study and can devote their time to the intricated problem of learning to fly.

Bert Shields, the author, and a light training plane used when civilian flying first became popular.

THE MOVEMENT to bring aviation into the high schools has made more progress in a few months than most educational innovations achieve in many years. New York state alone has appropriated $150,000 for the organization of ground school courses in the public secondary schools. Other states have either followed suit or are studying similar legislation.

The most urgent requirement is for qualified teachers, and the challenge to the educational systems as well as to the individual teacher is an immediate one. Perhaps never again will educators face so vital a need. The problem is being partially solved by the Civilian Pilot Training programs now being conducted for high school teachers in more than 650 colleges at CAA expense. Upon completion of these courses, the teachers are eligible to apply for CAA ground instructors' ratings. Obviously, mathematics and science teachers are best qualified to assume leadership in the program, but every educator interested in aviation has an equal opportunity to prepare himself for the task ahead.

If effective teaching depends upon eagerness to learn, educators have a made-to-order audience in America's air-minded youth. The enthusiasm fostered by model plane clubs and contests, radio programs, moving pictures, even newspaper comic strips, furnishes a foundation upon which educators can build.

The Curriculum

Perhaps the question most fundamental to the successful introduction of aviation training into the high school is, "What shall be the place of aviation in the curriculum as a whole?" The answer can be found only if teachers lay aside the jealousies impinging

Flying cadets learning how to adjust a parachute. Training time for cadets may be shortened by aviation training in high school. Courtesy U. S. Army Air Corps.

on subject-field divisions and, instead, view the curriculum in its entirety.

There are those who advocate that aviation should be made the core of the curriculum, that all teaching should have as its object the development of air-mindedness, training in necessary fundamental skills, and the knowledge of elementary aeronautics. Others, concerned with the development of able post-war leaders, fear the narrowing effect of such a program and recommend thorough preparation in mathematics and science basic to the study of aviation. When the house is on fire there is no time to argue about the relative virtues of various types of fire extinguishers. Both of these opinions have merit and offer constructive contributions to the coming pre-flight aviation program.

Aviation Courses

THE PROBLEM of the schools is to devise a program that will interest as many physically fit students as possible in military aviation, and at the same time offer adequate training in ground school subjects. The answer lies in courses patterned after those given by the Civilian Pilot Training program, which combines the best features of both the Army and Navy ground schools. The principal subjects are Theory of Flight and Aircraft, Aircraft Engines, Navigation, Meteorology and Civil Air Regulations. Additional subjects which may be taught in conjunction with the essential subjects include Radio, Parachutes and Aerodynamics.

Wherever possible, it would be advisable to set up the aviation courses on a sliding scale, keeping an ultimate two-year course in mind. Civil Air Regulations could be distributed throughout the other four main subjects under the title of Safety. Thus, the four subjects could be made available in the four terms of a two-year course. Temporary adjustments will have to be made to provide adequate training for those students who will graduate in six, twelve or eighteen months after the inauguration of the aviation courses.

Instructors

IDEALLY, every teacher participating in this program should have a pilot's license and ground instructor ratings in the main subjects. Flying and the ground courses essential to flying can best be taught by instructors who have experienced the pilot's problems in the air. However, with the schools speeding

to adapt the curricula to the nation's emergency needs, the aviation program cannot wait upon ideal conditions.

The best available compromise for every teacher who plans to take part in the program is first to take a few hours' dual flying instruction. The "feel of the stick" will not only give the teacher a more correct perspective, but will enable him to prove to the students the necessity and the value of the ground school subjects.

Text Books

THE SPEED with which aviation has entered the high school scene finds the field almost barren of adequate texts. The technical manuals available are not only beyond the high school student's understanding, but, moreover, are not easily adaptable to the teacher's assignment requirements. In a well-meaning attempt to fill the gap, aviation texts are being thrown together by persons with little or no aviation experience. Yet, to parody the old axiom, "haste makes murder" when applied to pilot training.

If stop-gap texts were merely inadequate or regrettable the educator could consider them as temporary expedients to be used until better books were available. But the inescapable fact is that a pilot training text not written from the pilot's point of view can be extremely dangerous. Misinformation, lack of information, or the wrong interpretation of basic facts at the very beginning of the student's aviation training may result in fatal accidents later on in his flying career. An aviation text can no more be written by an author who has never flown a plane than could a surgery text be written by a doctor who had never performed an operation.

WHO, THEN, is qualified to provide text material for the aviation program? Surely it is only those authors who combine pilot experience in the air with an understanding of education. Material not written by a pilot should at least be edited by one. Or the standard available manuals can be revised for high school use through the co-authorship of a professional teacher in each particular subject and a pilot thoroughly familiar with aviation ground school training.

These factors must all be taken into consideration in the selection of suitable texts. Further, the facts contained in the material must be authoritative; they must be presented from the correct air-usage point of view; they must be organized in logical lesson sequence; and they must adequately cover the four basic subjects of aircraft, engines, navigation and meteorology.

Revising the Standard Texts

The new emphasis placed on aviation by military tactics, the step-up in plane production and use, will carry over into the everyday life of the future. It is logical, then, to lay plans now for the important role aviation will play in every aspect of education.

No longer will the high school student study geometry merely because it is a required subject. When the student understands that a pilot's ability to return to an aircraft carrier from a reconnaisance flight depends on a knowledge of geometry, this realization will have the same effect on his study attitude as has a shot of adrenalin on a faltering heart.

Physics, though already better motivated than many subjects, provides another example. Airplane construction and control operations depend on mechanical principles. The action of the propeller and the behaviour of the plane in the air are direct applications of Newton's laws of motion. Charles, law of gases finds direct application in the ignition of fuel in Diesel engines and the power developed by the burning gases. Aviation applications of magnetism and electricity are abundant —the magneto, generator, electric starter, radio compass, instrument landing systems, etc.

EVERY Civilian Pilot Training Instructor has discovered that even many college students, although interested in flying, do not know the names of common airplane parts such as ailerons, flaps, tabs, elevators and spars. High school English departments can assume the responsibility of familiarizing students with the aviation vocabulary. English grammar and composition can as well be based on aviation as on other topics.

(Continued on page forty-one)

Science for Society

EDITED BY JOSEPH SINGERMAN

● **A department in which science is presented in its close relationship to the individual and in which guidance is given in causing the individual to recognize the methods of science and its vast social implications.**

NOW, everything else is secondary to those measures which will contribute toward speedy victory of democracy over Fascism. The coming offensive of our mighty armed forces will have the support of a powerful air arm. Science teachers are playing an ever increasing role in preparing American boys and girls to "face the inevitable and inescapable task before them," in steeling them for "the great adventure." Both Dr. Ralph E. Horton of the New York City Schools and Professor Paul R. Mort of Columbia University have participated prominently, during the past months, in the most intensive work of planning, preparing and guiding the tremendous task of getting the project of pre-flight training under way. Both are eminently qualified to tell about this program. An article by Dr. Mort will appear in the December issue. —*J. S.*

Pre-flight Aeronautics

In the New York City High Schools

RALPH E. HORTON

New York City Schools **New York, New York**

THIS is to be an account of how the New York City high schools prepared to participate in the all out effort to provide pilots for our air forces. If New York is further advanced in the program than some other parts of the country, it is due to its stimulation by and intimate association with the two forces chiefly responsible for the national interest in pre-flight training of boys at the high school level.

These two forces were the Air Training Corps of America and the Teachers College Aviation Research Group of Columbia University, sponsored by the Civil Aeronautics Administration. The headquarters for both of these organizations were in New York; and the New York City high schools participated actively in the programs of both groups.

When the call was made by the Army, the Navy, the Office of Education and by the New York State Department of Education, to help in recruiting pilots and to provide whatever instruction in the schools that was possible, the Board of Superintendents of New York responded promptly.

But what could the schools do? Opinions of pilots, educators and ranking officers in the army and navy differed. Some said ground school training could be useful only when accompanied by actual flying. Others said the traditional courses in mathematics and physics were all the preparation that the schools could give. Some said ability to fly was unrelated to knowledge of the principles. Others said the ground school training given by the army and navy could largely be taken over by the schools. Still others urged the setting up of a glider program; and some insisted the only way to prepare for aviation was by a thorough course of mechanics learned in an airplane shop.

IN SPITE of this confusion, a decision had to be made. In New York City, the following aims were formulated:

1. To stimulate interest in aviation among all the boys and girls and to urge boys nearing the age of induction to prepare for service in the air forces.
2. To provide a guidance program which

would enable a boy to decide, by reference to the standards of the army and navy, whether or not he was fit to be a pilot. Those whose qualifications, physical, mental, or psychological, indicated probable failure to meet the standards for pilots, should then be directed to prepare for other services in the air forces. It was hoped that, in this way, disappointment for the boys could be avoided and both time and expense on the part of the army or navy could be saved.

3. To set up an emerency program which would prepare boys who were candidates for the airforce to successfully pass the qualifying tests for air cadets.

4. To give courses covering, as much as possible, the ground school training now required of pilots by the Civil Aeronautics Administration, and by the Army and Navy. The consultants of the Army and Navy assured us that such training had the possibility of saving time and even of making better pilots. Their attitude was, "Show us!"

Experimentation

IF COURSES were to be introduced in September, preparation had to be made in three ways: (1) teachers had to be trained, (2) syllabi had to be worked out, (3) objective teaching materials had to be provided.

To prepare teachers, an in-service course was started in May. The instructors for this course were men in the school system who had pilots' licenses or ground school instructors' licences from the C. A. A. Most of these men were regular instructors in the Manhattan High School of Aviation Trades; two pilots were instructors in Brooklyn Technical High School, and one, a pilot from the Brooklyn High School of Specialty Trades. All were volunteers. The response of teachers to the invitation to take this in-service course was phenominal. At the first meeting over 450 teachers of mathematics and science appeared. Eight classes were formed but more than 100 teachers had to be denied registration. During the next week, more classes were formed, with three additional instructors. Even then, many teachers who wanted the course were unable to join these groups. The instruction consisted of lectures, demonstrations and moving pictures. Home work was required, and credit for the course was based on attendance at fifteen lectures of two hours each.

During the summer, another project to prepare teachers was instituted. A Summer College of Aeronautics was conducted at the Brooklyn Technical High School. In this program twenty-one teachers from the school system acted as instructors. All were pilots or held C. A. A. ground school instructors' licenses. Seven of the pilots were women. The organization of the work for the summer was based on a four-hour day. Each teacher who elected the course took one general lecture and two special courses daily. The courses offered for choice were: Navigation, elementary and advanced, Meterology, Aerodynamics, Radio principles, Radio Code Practice, and Aircraft Engines.

A FEATURE of this course was the visual instruction. Models of planes, wing sections and air foils were shown; numerous sound films were available; and the Jam-Handy set of films (slides prepared by the U. S. Navy) was in use constantly. An airplane shop and an engine shop were accessible for demonstration purposes. Three hundred and ninety-eight teachers completed the course during the summer. With a few exceptions, these were teachers who had not taken the course given in the Spring.

To prepare objective teaching materials, a committee of shop men, under the direction of Mr. Herman Berlin, gave three weeks of their summer vacation time. The shops of the Haaren High School Aviation Annex were made available through the cooperation of Mr. Philip Pinkus. These men did a marvelous job. Seventy-five sets of apparatus were prepared, one set for each high school. Each set consisted of (1) a solid model plane, (2) a wing section mounted so as to be lifted in an air stream, (3) three air foils, each mounted separately showing respectively the effects of the three controls: rudder, ailerons, and elevator. Each of these was

mounted on a wire frame so as to respond to a current of air from a fan.

Summary High School Courses

IN RESPONSE to the letter of Dr. Studebaker urging that the schools undertake the training of older boys during the summer months, the Board of Superintendents of New York opened nine high schools for Aeronautical Training. About eleven hundred boys above sixteen and a half years old volunteered to take this work. Some nine hundred of these boys completed a six weeks course. Credit of one unit toward graduation could be applied to either of the groups, science or mathematics. The instructors for these boys were about 250 teachers who had taken the In-service Course during the Spring. The purpose of the summer work was to prepare boys, who soon would reach the age of 18, to take the qualifying tests for pilots prescribed by the Army and Navy air schools. The syllabi were based on the manuals prepared by the U. S. Army, viz., TM 1-233 and TM 1-900. Each boy was supplied with a copy of each manual. The work consisted of three periods a day of class instruction and one period of physical training. The technical instruction for each boy was divided into one class in principles of physics applied to aircraft, one in mathematics applied to aeronautics, and one class in principles of flight. The physical training program was designed to toughen. The Bureau of Child Guidance cooperated by giving a health examination to each boy. Only boys whose physical condition was satisfactory were permitted to undertake the physical fitness program. Each school was equipped with a film slide projector, a sound moving picture projector and with appropriate instructional films.

Program for September

THE experimental classes working with the Teachers College, the summer school classes and the In-service Courses for teachers all contributed valuable experiences which guided us in preparing syllabi. The courses worked out by the Teachers College Research Group and the textual material which they prepared are to serve as our guide. Below is a brief outline of the program instituted in September in all high schools.

1. The following courses are open to both boys and girls who plan to become pilots, but are especially designed to prepare boys to enter the United States Air Forces.
2. *Aeronautics III and IV.* Standard Course (prerequisite 2 years mathematics and Physics or Aero. 1 and II)
   Aeronautics I and II. For boys without preparation in mathematics or physics.
3. These courses are based on the belief that a successful pilot must know certain principles of mathematics and physics involved in flight. It is recommended that boys of the lower term (below the fifth) who desire to be in the air force prepare themselves by mastering the principles of physics related to aeronautics and by acquiring facility in the use of mathematical calculations.
4. *Courses Recommended.* The courses in mathematics which are recommended are algebra, geometry, intermediate algebra and trigonometry. Solid geometry is recommended for all who have time. These basic courses are to be revised so as to relate by examples and applications to mechanics, electricity, meterology, radio and aeronautics. It is expected that the mathematics teachers and the science teachers will see to it that in each school there is correlation of the work and cooperation between the teachers of science and mathematics. The courses, Aeronautics III and IV, should normally follow the basic training in mathematics and physics as outlined above.
5. For boys and girls nearing the age of 18, who are eager to enter the air forces, but whose courses have not included mathematics, it is recommended that Aeronautics I and II be prescribed as substitutes for the standard courses in mathematics and physics. The aim is to give these boys the best preparation possible in the time remaining before they leave school. Aeronautics I is an intensive drill on the fundamentals of mathematics

(Continued on page forty)

Some Insect Friends of Man

LEE H. TOWNSEND

University of Kentucky **Lexington, Kentucky**

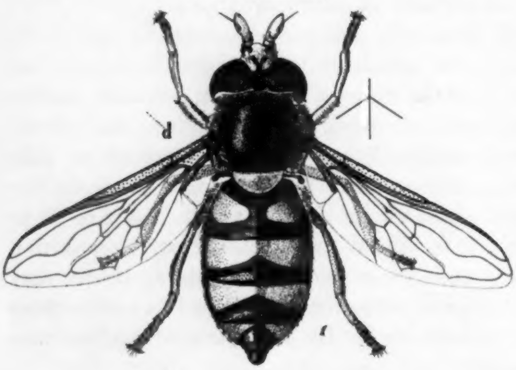
SINCE most of the accounts of insects deal with their destructive habits we are always in danger of forgetting that many are beneficial, and these we are apt to underestimate. Each individual owes it to himself to know something about how certain insects help man. In this one article we are unable to explore the subject very deeply but will merely select one phase which is little known.

Insects and Man

Of the various benefits derived from insects probably the most important, if it could be accurately measured, is the good that insects do by fighting among themselves. Without a doubt the greatest single factor in preventing plant-feeding insects from destroying the rest of the world is that they are fed upon by other insects. When we think of the industry of insects, their devotion to a job, and the almost unlimited numbers of individuals, it is not difficult to see how they do a good job for us when they turn against pests scattered over a farm or a wooded area. These will probably do more toward controlling man's insect enemies than he can do himself.

THESE insect eaters are spoken of as entomophagous insects, and are divided into two groups known as (a) predators and (b) parasites. Predators are insects that catch and devour smaller or more helpless creatures usually killing them in getting a single meal. The creature which is caught and devoured is generally smaller and weaker than the predator and is called the prey. Parasites are insects that live on or in the bodies of other living organisms from which they get their food. The organism on or in which the parasite lives is usually larger and stronger than the parasite and is called the *host*. The host is not killed promptly but continues to live during a period of close association with the parasite. The host determines the habitat for the parasite but the prey does not necessarily fix the habitat for the predator. A single host individual is sufficient to nourish a young parasite to maturity, while a predaceous insect takes many individual victims before completing its development.

Fig. 1. An adult flower-fly. (After Metcalf in the Ohio Naturalist.)



THOSE WHO WORK with insects are realizing more clearly each year the great importance to agriculture and human welfare of the groups of insects having the predaceous or the parasitic habit. There seems to be not the slightest doubt that these insects are man's greatest ally on keeping destructive insects in control. They work usually unnoticed, require no attention on the part of man, and thus most of us are unaware of their existence. Occasionally some combination of conditions checks their numbers and we experience a serious outbreak of the pests which these beneficial insects have been holding in check and which would otherwise be serious every year.

It therefore seems worthwhile for us to learn something about the habits of some of these common beneficial insects. In so doing we will be better able to appreciate their value and at the same time will become acquainted with some facts of scientific importance.

MONG THE most widely distributed and valuable insect predators are (1) the Flower-flies or Syrphidea; (2) the Ladybird

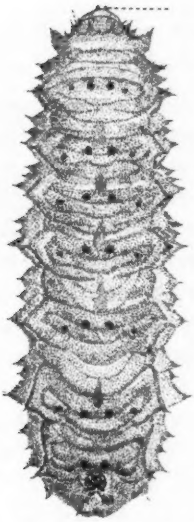


Fig. 2. Maggot of a flower-fly. (After Metcalf in the Ohio Naturalist.)

beetles or Coccinellidae; and (3) the Lace-winged Flies, Aphis-linons or Chrysopidae. It so happens that the above-named predators all feed commonly on the plant-lice or aphids which compose one of the most universally distributed and destructive of the insect groups. This destructive group owes its success, not to the hardiness or resistance of the individuals, but to their remarkable ability to prodce young aphids so fast and in such great numbers. The individual aphid is very frail, defenselelss and exposed throughout its life.

As illustrations of predaceous insects let us consider briefly each of the above named groups as enemies of aphids. Naturally these predators do not always confide their attacks and feeding to this prey but practically every aphid colony has its group of predators.

Flower-flies or Syrphidae: Although the

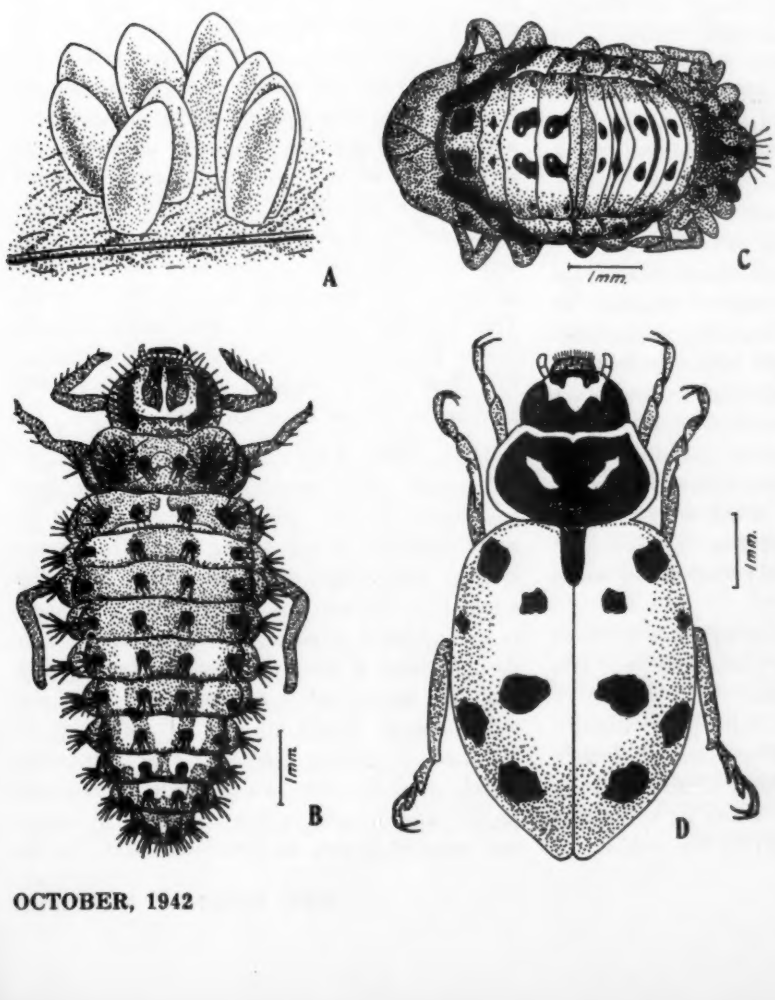


Fig. 3. The four stages of a lady beetle. (A) eggs; (B) larva; (C) pupa; (D) adult. (Courtesy of Kansas State Board of Agriculture.)

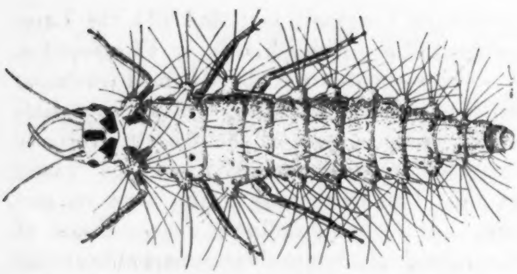


Fig. 4. An aphis-lion. (Courtesy of Illinois State Natural History Survey.)

name "Flower-flies" gives no indication of the economic importance of the group, it seems to be the most satisfactory common name now in use for the adults. This name is based on a very characteristic habit of the adults, namely that of visiting flowers for the purpose of feeding on nectar and pollen.

THE family Syrphidae is a large one and belongs to the order Diptera, or two-winged flies. They are medium to large flies (Fig. 1) and are usually, though not always, bright-colored; being striped, banded, or spotted with bright yellow on a dark background. This dark and yellow coloring gives them a striking resemblance to wasps and hornets for which they are commonly mistaken. Some persons know them as "Sweat-bees" and think they can sting, but, they cannot harm a person in any way. A very simple way to distinguish these flies from stinging insects is the distinct manner of flight. In flight the Flower-fly may constantly poise in the sunlight, or about flowers, being able to remain suspended in one place for a considerable time by moving the wings so rapidly they are practically invisible. Then very quickly they will dart away. If the insect is in your hand, see if the wings of one side can be separated into two. The Flower-flies, of course, have only one wing on a side.

During its entire existence any one of these flies passes through four distinct stages: The egg, larva, pupa, and adult.

The eggs of the larger kinds are usually about one twenty-fifth of an inch in length and are usually about three times as long as wide. They are chalky white in color and are frequently placed right in the aphid colony so that when they hatch the young may easily find an abundance of food.

UPON HATCHING there appears from the egg a very small, headless, footless, blind, creeping maggot, known as a *larva*. This sluglike larva or maggot (Fig. 2) usually has a mottles brown or green color. It moves slowly and surely about the leaf in search of food. Finding an aphid which it quickly seizes by firmly attaching the mouthparts to the body, the body-wall is punctured, and the aphid usually lifted high in the air. When the larva is searching for food the front half of the body is raised in the air, extended, and lashed from side to side. It is then attached and the hind part of the body is pulled up, then the movement is repeated. The sense of touch and not smell seems to be used by the larvae in finding their food. Frequently hungry larvae pass so close to aphids they almost touch them but go on in search of others. When the body-wall of the aphid is pierced by the mouthparts then begins the process of slowly sucking out all the body liquids. This process may continue from a fraction of a minute to more than an hour in the case of very young larvae. The skins of the aphids, sucked absolutely empty are discarded by the maggots. These skins may sometimes be seen in numbers on the host-plant, or they may drop and be blown away. The feeding period of the larva usually varies from about 7 to 15 days and during this time each larva may consume up to 400 aphids depending upon their size.

WHEN THE LARVAE has completed its growth, it is usually about a half inch in length. At this time it comes to rest in some suitable place in or near the larval habitat and prepares to transform into the adult fly. During this third stage the insect is said to be a *pupa* or is in the pupal stage. At this time it becomes shorter and thicker than the larva, takes no food and does not move about. The hind end of the body is attached to some support. The *puparium* which encloses the insect while it changes to the adult form is oval, oblong in shape and usually brown or green in color. In the

greater number of cases the pupal stage lasts from 4 to 10 days.

WHEN FULLY formed and ready to emerge the adult pushes off a lid-like portion of the front end of the puparium and crawls out. Emergence may require several hours' time and the specimen may die in the attempt to disentangle itself from the puparium. Very soon the insect assumes the adult form, the wings which have been crumpled fully expand and the specimen is now a fully formed adult. At this time the life of the fly seems dominated by two impulses, the instinct to feed and to lay eggs to reproduce its kind. After mating which occurs either on the wing or while resting on foliage the eggs are deposited and the next generation is provided for.

By examining some plant which is infested with aphids one can usually find, without difficulty, several of the maggote which should be recognized from the foregoing figure and description. If these larvae are kept in a small covered glass dish and fed a supply of aphids every day, their feeding can be observed and they will soon change to the adult fly. The aphid skins and other remains should be removed from the dish each day.

MANY TIMES has the writer reared these larvae through to adult flies in a small glass dish on the laboratory table. In this way we are able to get some idea of what takes place outside in the aphid colony.

Lady bird beetles or Coccinellidae: The beetles of the family Coccinellidae, known by various names as "ladybirds' or "lady beetles" are among the most common of all beneficial insects. Many kinds of these useful insects are widely distributed and often occur in enormous numbers. In the case of these insects both the adults and larvae feed upon a wide variety of soft-bodied insects such as aphids, scale insects, mealybugs, white flies, and red spiders. Each kind of a lady beetle is more or less restricted to a particular insect or group of insects and does not feed indiscriminately. Those which prefer aphids as food usually seek out these insects as prey.

The adult beetles (Fig. 3, D) are known to a great many people as they are so common and many are brightly colored. They are almost hemispherical in shape and the commonest species are red, brown, or tan usually with black spots. A few are black, maybe spotted with red. They are usually from one-sixteenth to one-fourth inch long and about two-thirds as broad.

THE life histories of these beetles are similar, that of the convergent lady beetle being typical. They all pass through the four stages of egg, larva, pupa, and adult during development. We can use the above named beetle to illustrate the life history.

The eggs (Fig. 3, A) are lemon yellow in color, spindle-shaped, and each measures about one-twentieth of an inch in length. They are deposited in clusters of from 10 to 30 upon the foliage, usually near an aphid colony. Each female may deposit as many as 1,000 eggs. In summer hatching occurs in about 5 days.

The larvae (Fig. 3, B) of these beetles are carrot-shaped, having distinct body regions, long legs, and warty backs. Most of them are conspicuously colored with patches of blue, black, and orange. The larva of the convergent beetle feeds for about 16 days during which time it is very active in its search for food and may eat from 200 to 500 aphids. These larvae have efficient chewing mouthparts and devour most all of the aphid body.

WHEN THE LARVAE has finished feeding it is ready to enter the resting or pupal stage. This pupa (Fig. 3, C) is not enclosed in a cocoon but is exposed on the leaf to which the tip of the abdomen is cemented. This stage lasts from 6 to 8 days, after which the beetle appears and begins to feed. During the summer these adults may live from 1 to 2 months, and during this time consume up to 100 aphids per day.

The overwintering habits of many of these beetles are of particular interest. As the cooler weather of fall and winter approaches these beetles leave the fields and gardens where they have been feeding and migrate to woods, fence rows, and such places where they assemble in vast numbers under leaves, grass or some protecting cover. Here they pass the winter in colonies

(Concluded in December Issue)

Association Programs for Science Teachers

FRANKLIN T. MATHEWSON

White Plains Public Schools **White Plains, New York**

EACH YEAR scores of science teachers are placed in offices for which they have had but a slight background of experience and are expected to arrange and carry out programs for the many science teachers' associations throughout the country. That they achieve the general level of excellence that they do is a tribute to American ingenuity, resourcefulness, and professional interest. A real association program in its fullest sense includes not only an instructive, educational, thought-stimulating entertainment for assembled groups of science teachers but also the more important "year-round" program of constructive activity carried on through out the year by committees of association members. This article deals with both types of programs.

As the writer had been faced with promoting year-round and meeting programs he was motivated to include these types of in-service education in a recent research study[1]. A brief description of the research technique employed and an evaluation of 54 important professional needs of science teachers, together with an evaluation of the ten "best" in-service educational devices for meeting each of these needs, appears in the February (1942) isue of *Science Education*[2]. As explained more fully in the above mentioned sources, the conclusions of the research, a part of which are included in this article, are based on pertinent literature, personal interviews, and three different questionnaires returned by over 500 people representing all states in the Union and some foreign countries. Great effort was made to contact each state and large regional associations.

Year - Round Programs

A CONTINUITY of effort on the part of officers, committees, and many members throughout the year, in spite of the difficulty in getting together, has marked the activities of the more "successful" science teachers in recent years. For example the New York State Science Teachers Association had fifteen functioning committees for the year 1941, namely: program, handbook, speakers bureaus, publicity, constitution, research, curriculum, *News Bulletin* (the official printed magazine), membership, source materials, resolutions, summer conference, science group meetings, nominations, and auditing. Over two-thirds of these committees worked throughout the year and none handed in last minute reports. At the last annual meeting two of the three scheduled days were devoted to business and committee meetings.

CONCLUSIONS from the author's research show that the major effort of associations' year-round activities should deal with modern trends in the curriculum. Pre-eminent at the time of the research, in the approximate order of importance, is the desire of year-round programs for:

A. The development of a science sequence from grades one to twelve or fourteen.

B. The development of curricula functional to the personal, social, and community needs.

C. The promotion of science in the general curriculum.

D. An official science educational publication.

E. Curricula that:
   1. Are related to the general educational program.
   2. Consider non-academic pupils
   3. Are integrated and not overlapping

F. Local association support to sanitation, health, and safety drives.

G. Co-ordination of research and curricular studies.

[1] Mathewson, Franklin T., *A Study of the Contributions of Certain Professional Activities to the In-Service Education of Science Teachers in Secondary Schools.* Doctor's Thesis (unpublished) New York University. 1941. Pp. xiii 449.

[2] An Evaluation of In service Education Devices for Meeting Specific Needs of Science Teachers in Secondary Schools.

H. Publication of research and curricular studies.

I. Co-operation with state educational authorities.

J. Stimulation of research and curricular studies.

K. Co-operation with state educational authorities.

L. Assistance to local science teachers' associations (particularly outside of the larger cities).

M. Placement bureau for science teachers.

N. Newspaper and general educational magazine publicity.

ASSOCIATIONS can be of value in other ways such as research in teaching methods, showing the value of science, improving teaching qualifications and professional status, and in developing criteria embracing other trends such as consumer education and scientific thinking, but there is insufficient evidence from this study to determine their relative value. Moreover the problem of civilian and national defense which has emerged since this study was undertaken would doubtless add other categories or modify some of those listed.

Interesting variations are shown in the ratings given by the different groups. The teachers of the larger schools are lower in most of their evaluations. Teachers in the smaller schools emphasize, relatively: "placement bureau for science teachers," "assistance to local science teacher associations," "cooperation with the state educational authorities," and are less interested in "the relation of science to general education." They are not quite as concerned about the non-academic student. Professors of science education are more interested in the stimulation and coordination of research activities and in the promotion of science in the general curriculum. The administrators place little value on a placement bureau for science teahers (which might be one good reason for not attempting it) and have less interest in integrated science.

It has frequently been said that the best way to get an individual interested in an organization is to put him at work on some project of the association. Science teachers' associations are no exception. The above list of year-round activities offers sufficient work for many members — and its not just "busy-work" either, although it certainly can keep one busy.

Programs for Meetings

THESE PROGRAMS certainly range from excellent to mediocre, or worse, if one can believe what one hears. Perhaps you have experienced the range yourself. A program chairman can not hope to please everybody. Science teachers are trained to be critical. But — is there any doubt but what the standards for programs would be raised if greater care were given to the selection of program chairmen and greater assistance afforded them? So often the job is apparently "wished off" on some one, frequently a person who is absent. If, as a member or chairman of a nominating committee, you have made hasty or superficial selections you deserved no better than you received at the next meeting.

Conclusions from the writer's study as to the best types of programs for science meetings show two distinct favorites:

A. Scientists from other professions or industries explaining new developments and advances in science, or new industrial products and applications.

B. Classroom teachers demonstrating student or "home-made" apparatus, or explaining specific methods and projects successfully used with a particular unit or group of students.

C. Other demonstrations in their approximate order of value are those using:
   1. Slides or movies
   2. Living material
   3. Professionally made apparatus
   4. A class of pupils
   5. Tables and charts

D. Other speakers in their approximate order of value are:
   1. Secondary science supervisors
   2. Professors of the special sciences from universities
   3. Professors of science education

   The ability of the individual speaker means more than his classification.

(Continued on page forty-six)

HARRY A. CARPENTER
Specialist in Science
Rochester Public Schools.

Former president and one of the organizers of the American Science Teachers Association.

Born 1878, Died 1942

OUTSTANDING as an author, teacher and educational leader in science education, the late Harry A Carpenter, specialist in Science in the Rochester Public Schools of New York State, was widely known among those in his field.

He leaves a remarkable record of achievement that should serve to encourage those who aspire to do worthwhile things. His ability as a teacher, supervisor and educator was early recognized. He was appointed as a member of the New York State General Science Syllabus Committee and also became co-author of a series of successful science texts for the grades and high school.

One of his unique innovations of general interest is the use of the radio for science instruction in the shools. He experimented with recorded science lessons and cooperated in the making of the first instructional science films.

To many people he was personally known through the many science teachers' associations in which he was active. His leadership, both in his own state and nationally, is indicated by the fact that he was chosen four different times as president of the New York State Science Teachers Association, became president of the National Association for Research in Science Teaching and for six years was president of the American Science Teachers Association.

As an organizer of science groups, his record is outstanding. In addition to local organizations for which he is responsible for establishing, he was one of the organizers of both the National Association for Research in Sciene Teaching and the American Science Teachers Association. It is with the latter organization that he has probably achieved the greatest success in cooperative activity among science teachers.

Program

The American Science Teachers Association

Hotel Pennsylvania, New York City, December 29 and 30, 1942.

TUESDAY, DECEMBER 29

Dinner Meeting, Board of Directors, 6 P. M. Hotel Pennsylvania.

Student Science Congress, Evening. American Museum of Natural History.

WEDNESDAY, DECEMBER 30

Hotel Pennsylvania

Morning Session — Topic: *Science Teaching in War-Time.*

1. As Related to Aviation. Dr. Ralph E. Horton, Chairman, Standing Committee on Science, New York City Schools.
2. As Related to Nutrition. M. L. Wilson, Assistant Director in Charge of Nutrition, Office of Defense, Health and Welfare Services, Federal Security Agency, Washington, D. C. Former Under-Secretary of Agriculture.
3. Science Instruction at All Levels in Relation to the War Effort. Brigadier General Lewis B. Hershey, Director, Selective Service System, Washington, D. C.
4. Experiences in the Teaching of Special Defense Training Courses in Science. Dr. Arthur Rose, Pennsylvania State College. Supervisor for Chemistry, E.S.M. D.T., State College, Pa.

Luncheon.

Presiding: Dr. Otis W. Caldwell, General Secretary, A. A. A. S.
Speaker: Dr. Arthur H. Compton, President of A. A. A. S.

Afternoon Session — Topic: *Curricular Problems.*

1. The Sequence of Science Studies in New York State. Dr. Warren W. Knox, Director, Division of Secondary Education, New York State, Albany, New York.
2. The Sequence of Social Studies. Professor Roy W. Hatch, Head of Department of Social Studies, State Teachers College, Montclair, New Jersey.
3. Discussion: The Implication of Sequences for the Secondary Curriculum as a Whole. Led by Dr. Warter Thurber, Instructor and Critic Teacher in Science, New York State Teachers College, Cortland, N. Y.
4. The Science Survey Course for College Freshmen. Dr. Benjamin Harrow, Department of Chemistry, College of the City of New York, New York City.

Note: Science teachers from all areas are invited to attend the meetings of the association, whether members or not. Those desiring to become members may do so by sending the membership fee of one dollar to the treasurer of the American Science Teachers Association, Mr. Leo J. Fitzpatrick, Treasurer, Brockton High School, Brockton, Massachusetts. Science teachers associations, even if not affiliated, are invited to send representatives to the meeting.

Science Clubs at Work

EDITED BY KARL F. OERLEIN

State Teachers College California, Pennsylvania

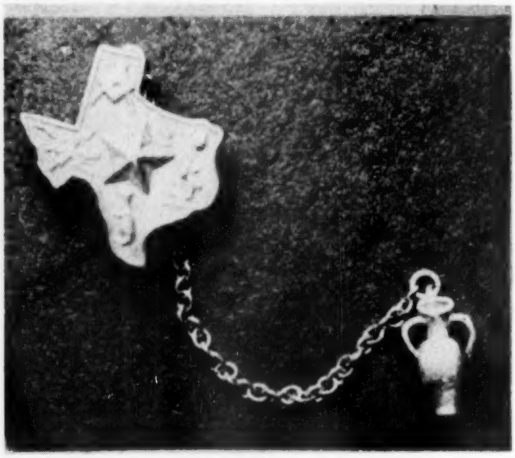
A department devoted to the recognition of the splendid work being done by the science club members and their sponsors in the various State Junior Academies of Science. Material for this department, such as student made projects; demonstrations and posters; outstanding club programs; state and regional meeting announcements; should be sent to Dr. Oerlein.

Texas Junior Academy of Science

GRETA OPPE

Ball High School Galveston, Texas

THE JUNIOR Division of the Texas Academy of Science was conceived and organized through the efforts of Dr. Clyde T. Reed, now of Dozier, Alabama. In 1930 Miss Greta Oppe of Galveston, Texas was appointed by the Senior Academy to cooperate with Dr. Reed in the development of a Junior Academy in Texas. It was not until 1934 that the Junior Academy became a reality in Texas due to the fact that the Texas Academy of Science held its annual meetings at the same time that the Texas State Teachers Association held theirs only in different meeting places thus making it difficult for teachers to cooperate.



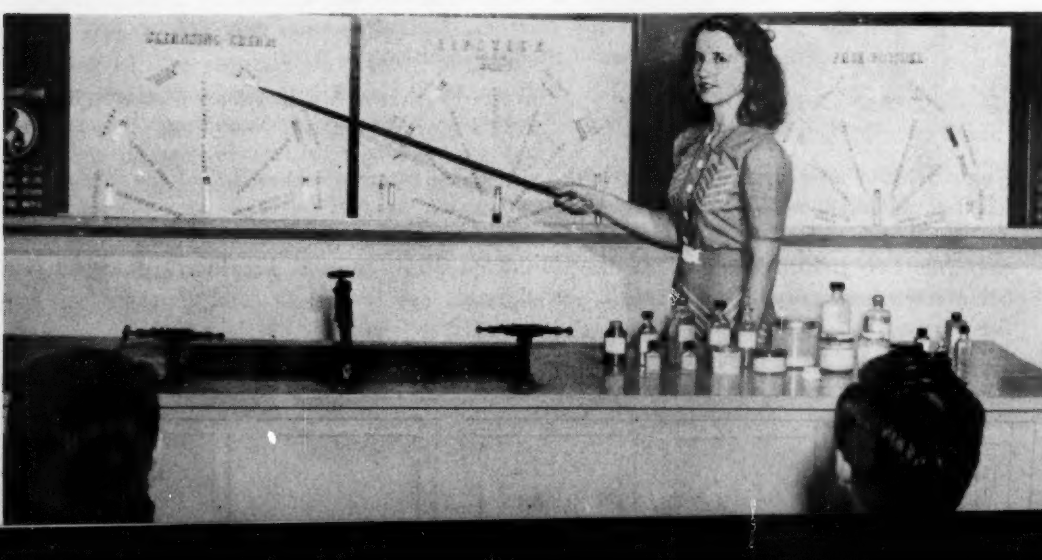
Gold medal award of Texas Junior Academy

Miss Vesta Hicks, formerly co-ordinator of science in the Austin Public Schools, and the "Science Club News' which she edited, did much to affiliate school clubs with the Academy of Science in Texas. Today all activities of the Junior Division are recorded in a bulletin called "The TexSciana" edited by Mr. Sigman Hayes of the Austin High School. Any science club may become a member of the Texas Junior Academy of Science by paying an annual fee of two dollars. The sponsor of each affiliate must also be a member of the Academy of Science.

Because of the size of Texas, the state is divided into four regional areas, East, West, South, and Central Texas divisions, each area presided over by a regional director elected by the Junior Academy Committee consisting of seven members and the four regional direc-

(Continued on page thirty-two)

Presenting cosmetics before Texas Junior Academy.



Arterial Injections and Injection Masses*

LOLA LEE DYESS

Austin High School — Austin, Texas

IN THIS project, the arterial systems of cats and toads were injected with six different masses for the purpose of displaying the arteries, comparing the masses, and acquiring skill in injecting.

When working with toads, the animal was etherized, and an incision was made down the entire length of the ventral body wall. The pericardium was slit, and the heart was moved into a convenient position. A rubber bulb and a one and one-half inch veterinary's needle were used. The needle was inserted through the ventricle into the conus arteriosus, and the auricles were pinched closed to keep the fluid from entering the veins. Injection mass was then forced into the arteries, and the injection was stopped when the arteries of the stomach became plainly visible. The animal was immediately immersed in a pan of cold water to harden the mass. This cooling was necessary with all except the two latex masses, which did not backflow.

A SIMILAR procedure was followed when injecting cats. A metal plunger-type syringe, which could be stopped as many times as necessary during the injection, was used with a two-inch veterinary's needle. Before beginning the injection, a string was placed under the aorta about a fourth of an inch from the heart. The needle was then inserted into the left ventricle and worked upward into the aorta. As in toads, the injection was stopped when the arteries on the stomach became plainly visible. Immediately after withdrawing the needle, the string previously placed around the aorta was tightened with a surgeon's knot to prevent backflow. The cats were also immersed in cold water.

In all, about three dozen toads and eighteen cats were injected, and preserved in a 10% formaldehyde solution until they were removed for dissecting. Dissections were made to show up the arteries. Two well-injected and well-dissected toads were mounted in museum jars. The most difficult exhibit to prepare was the arterial system

(Continued on page forty-two)

* Presented at the meeting of the American Science Teachers Association, Dallas, Texas, December 30, 1942. Won the gold medal of the Texas Junior Academy of Science, May 3, 1941, Waco, Texas.

A Tuberculosis Testing Campaign in High School

MATHIS BLACKSTOCK*

Austin High School — Austin, Texas

I AM GOING TO present an outline of the plan that I followed in organizing and putting over the tuberculin test for Austin High School.

With the idea of service in mind, the Raymond Ditmars Scientific Society decided to initiate a tuberculosis testing campaign for the whole school. Harold Bolding, president of the club, appointed me chairman of the project committee. It was my duty to organize and put over the campaign. I went to the Texas Tuberculosis Association and the Austin-Travis County Health Unit for ideas and arrived at the following program:

1. Get permission to give the test in Austin High School. This must be obtained from the principal, student council, school doctor, and school superintendent. All of these persons and groups readily granted permission.

2. Test all members of the Ditmars Club, with the idea of acquainting them with the test. The Mantoux test was used throughout the entire program. This consists of a subcutaneous injection in the skin of the forearm. Forty-eight hours later the injection area is checked, and if a red spot is present, the tuberculosis germ is in the body. Whether the disease is active must be determined by an x-ray. The test was given for the Ditmars Club November 13, and reactions were checked November 20.

3. Educational campaign. I initiated this campaign by organizing three committees within the club: newspaper publicity, radio publicity, and posters and exhibits. Other phases of publicity included speeches and motion pictures for assembly periods, speeches in advisories, and contact in the homes through the Parent Teachers Association and the Texas Tuberculosis Association.

4. Actual administration of the tests took place December 1 through December 11. The tests were given only to those students who procured written permission from their parents. The tests were administered during the study periods by officials of the Austin-Travis County Health Unit, which volunteered services of doctors, nurses, and equipment. The Ditmars Club, the Lyman J. Bailey Club, and the Y. T. S. Botanical furnished student aides who did all of the clerical work.

5. The follow-up includes:

1) X-rays for all positive tests, which numbered 200 out of the 1100 students tested. In regard to payment for x-rays, the students fall into three groups:

Group 1. Those that cannot possibly pay for x-rays go to Brackenridge Hospital and have them made free of charge.

Group 2. Those who cannot easily spend money for x-rays are provided for by funds to be raised through civic service organizations, the raising of these funds to be organized by a committee from the Ditmars Club.

Group 3. Those who can pay for x-rays are able, through arrangement made by Dr. Harold Wood, City Health Unit Director, to pay a reduced rate of $5.

2) A permanent record for future reference.

3) Establishment of a testing program for each new class as it enters Austin High School.

4) People found to have active cases will be certified to the Tuberculosis Association and City-County Health Unit for case work.

AS STATED before, 1100 students were tested. This is 51% of the total school enrollment. This was generally considered successful, but it certainly could have been more successful. In my estimation, the educational campaign was the main weak point.

* A member of the Raymond L. Ditmars Scientific Society of Austin High School, chosen as Honorary Junior Member of A. A. A. S. for 1942 from the Texas Junior Academy of Science. He appeared on the program of the American Science Teachers Association, 1932, in Dallas, Texas.

The Nelson Cell as a Chemistry Project

BRUCE B. JACKSON

Senior High School **Easton, Pennsylvania**

CHLORINE, the most useful product of the Nelson cell, is used in large quantities for bleaching and the purification of water. Chlorine is produced commercially by the electrolysis of brine. Several electrolytic cells have been invented for this purpose. One of the most successful of these was the Nelson cell. Besides producing chlorine, the cell also produces hydrogen and sodium hydroxide, which are commercially valuable.

The accompanying diagram shows a cross-section view of a working model of the Nelson cell which I built. The essential differences between the commercial cell and my working model are that my tank is round, instead of trough shaped as in the real one; and also mine is made of glass instead of a steel. However, this has the advantage of permitting one to see the cell working.

THE CELL was built from materials which were easy to obtain. The glass container was an ordinary gallon jug. I took the bottom out of the jug by wrapping string around it about a half-inch from the bottom. I soaked this with kerosene and set it on fire. When the string was pretty well burned, I submerged the jug in cold water which caused it to crack in an even line under the string.

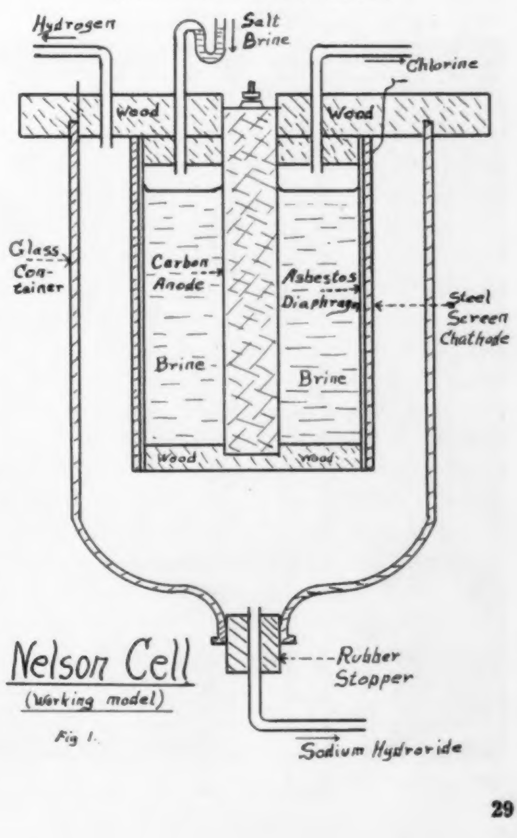
I turned three wooden parts on my lathe, one large disc for the top of the outer container and two smaller discs for the top and bottom of the inner container.

The asbestos diaphragm was installed by wiring it firmly to the top of the inner container which in turn was nailed to the top of the outer one. The diaphragm was also wired to the bottom of the inner container. The bottom was held in place by the asbestos diaphragm and the carbon anode, which was obtained from a dry cell battery. The steel screen used for the cathode was ordinary metal lath used in plastering. It was wrapped around the diaphragm and had an electrical connection to the source of current.

I used parafin to seal all of the joints arounds the diaphragm and the glass container, but had to use sealing wax around the lead wires because they were not heavy enough. This caused them to heat up, thus melting the paraffin.

I MADE three attempts to construct this cell so it would produce properly. When I first tried it, I found that the asbestos diaphragm was too thick because the brine did not come through fast enough to make the operation of the cell practical. I did believe, however, that I was on the right track because slight traces of chlorine could be found and the brine which did get through the diaphragm tested basic, proving that at least some of the brine was decomposed. I found that the paraffin which I used to seal the lid onto the glass container was leaking. This explained the fact that no hydrogen could be found, but I knew that there must be

(Continued on page forty-four)



Nelson Cell
(Working model)
Fig 1.

Apparatus to Demonstrate Falling Bodies

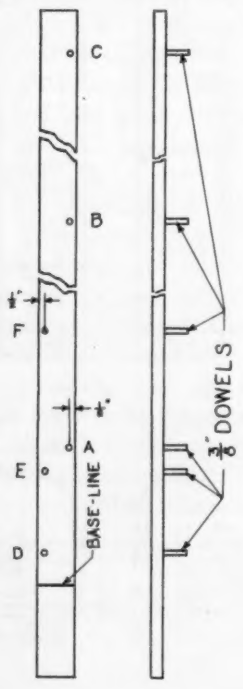
M. J. W. PHILLIPS

West Allis High School — West Allis, Wisconsin

ONE OF the most difficult parts of high school physics is to teach accelerated motion due to falling, as well as an understanding of the pendulum, a phenomenon which is presented at the same time. Some textbooks in high school physics do not discuss the mathematics of either, while others take it up in a very elementary way.

This project for illustrating the action of falling bodies involves two quadratic equations of which every high school physics pupil should have some knowledge. They are: $S = \frac{1}{2}gt^2$, for distance traversed by a body under the influence of gravity, and $t = \pi\sqrt{\frac{l}{g}}$, known as the pendulum formula. In the latter t is the time in seconds of a single vibration of the pendulum; π is 3.14 which is a constant; l is the length of the pendulum in inches or centimeters; g is the gravitational constant which is 32.2 feet per second per second, or 980 centimeters per second per second. Problems involving these equations are often solved, but *real* understanding is sadly lacking.

Fig. 1. Schematic drawing showing the board with base line and three 3/8 inch holes bored one foot at "A", four feet at "B", nine feet at "C". The pendulum lengths on the left at "D", "E", and "F."



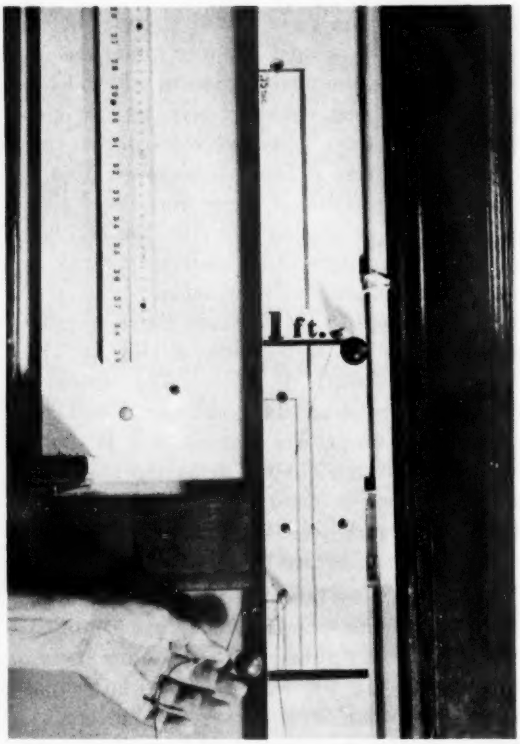


Fig. 2. Shows how the falling ball is released at the same time the pendulum is started. This is from the 1 foot height. The same method is used for the other heights and pendulum lengths.

You may begin the project with the class by presenting six problems. The first three are,

1. How long (time in seconds) does it take a body to fall one foot?
2. How long (time in seconds) does it take a body to fall four feet?
3. How long (time in seconds) does it take a body to fall nine feet?

These three problems are solved by using the formula $S = \frac{1}{2}gt^2$, which can be written for t in this form $t = \sqrt{\frac{2s}{g}}$. In solving this the pupil will determine that it takes .25

seconds to fall one foot; .50 seconds to fall four feet; and .75 seconds to fall nine feet.

NOW YOU are ready to present the three other problems which use the results of the first group.

4. What is the length (in inches) of a pendulum, the time of which is .25 seconds for a single vibration?
5. What is the length (in inches) of a pendulum, the time of which is .50 seconds for a single vibration?
6. What is the length (in inches) of a pendulum, the time of which is .75 seconds for a single vibration?

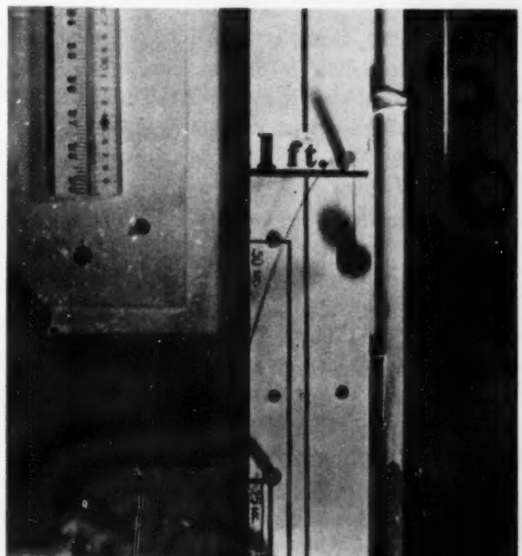
These problems are solved by using the formula, $t = \pi \sqrt{\frac{l}{g}}$. Writing this formula for l we have $l = \frac{gt^2}{\pi^2}$. The pupils will find the length of the pendulum to be as follows: (4) for time of .25 seconds, length 2.25 inches; (5) for time of .50 seconds, length nine inches; (6) for time of .75 seconds, length 20.1 inches. The metric system may be used instead of the English system if the instructor prefers; in fact, it would be interesting to make this project from a set of problems using the metric system for comparison.

UP TO THIS point these figures are merely numbers, just answers to physics problems, and have little or no meaning to the average physics pupil other than an answer. Now you are ready to make the pupil see the need as well as feel the need for the *activity with a purpose* — the project. Secure a fence board ten feet long and 3⅝ inches wide at the approximate cost of twenty-five cents; one piece of ⅜ inch doweling at the cost of three cents, which will make six pegs three inches long; two brass balls, either ¾ inch or one inch in diameter, drilled so they may be suspended (these cost about thirty cents), and a spool of heavy thread to suspend the balls. Total cost will be less than seventy-five cents.

The board is measured as shown in the drawing, Figure 1. About ten inches from one end, draw a line across the board. This is the base line or bottom. Along the right edge of the board and from the base line, measure and mark the distance of one foot, four feet, and nine feet, labeled "A", "B", and "C" respectively. At each of these points, and a half inch from the edge of the board, bore a ⅜ inch hole into which may be fitted a ⅜ inch dowel pin as a peg. On the opposite edge of the board one inch from the edge bore three ⅜ inch holes at the distances of 2.25 inches, nine inches and twenty inches respectively from the base line. These are shown as "D", "E", and "F" in the drawing and are the pendulum lengths.

THE .25 second pendulum is suspended from the peg 2.25 inches from the base line; a short piece of thread is used to hold the pendulum to one side as shown in Figure II. The ball used as the falling body is held up to the peg one foot above the base line. Note that the same thumb and fore finger holds the ball up, as well as the pendulum to one side. Thus when released both will start at the same instant under the force of gravity. Figure III shows the ball on its way to meet

Fig. 3. Shows the ball on its downward journey from the 1 foot level to meet the pendulum which has just been released.



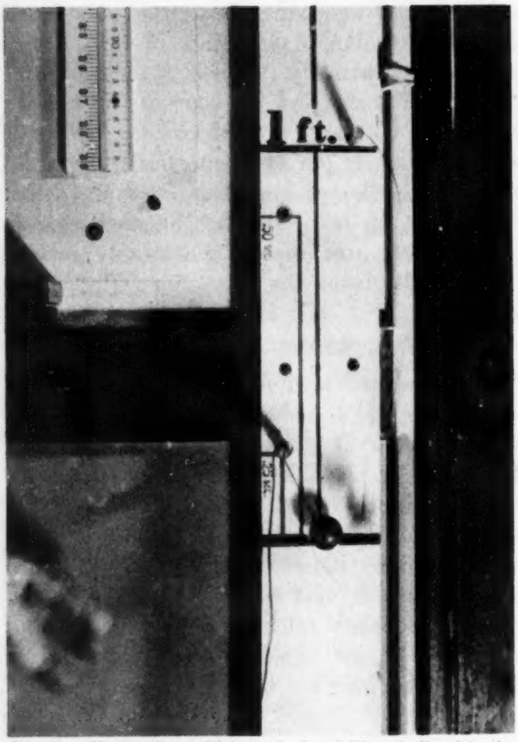


Fig. 4. Shows the collision of the falling ball with the pendulum, furnishing the proof that the time of fall and the period of the pendulum are the same.

the pendulum, and Figure IV shows the falling ball colliding with the pendulum bob, indicating that the time of fall is the same as the time of the pendulum swing. This fact demonstrates that the solution of the problem must be correct. The pegs are removed and replaced in the next set of holes above the base line, marked "E" and "B" in the drawing. The pendulum is released together with the ball falling through four feet. The result will be a collision on the base line. Again, this may be repeated for the nine foot fall (marked "C" in the drawing) and the twenty inch pendulum length (marked "F" in the drawing). With practice pupils will be able to test various distances of fall with corresponding pendulum lengths, within the range of room height.

THIS activity serves to make *real* portions of high school physics, which heretofore have been merely answers to problems. Pupils can readily see that the distance of fall varies with the square of the time as: one unit of time, one unit of fall; two units of time, four units of fall; three units of time, nine units of fall. The unit of time in this instance is $\frac{1}{4}$ second and the unit of fall one foot.

Explain that these short units of time and distance are used so that the relationships could be shown within the limits of the height of the average school room. The simplicity of this equipment, and the fact that answers to physics problems may be seen in terms of holes bored in a definite place in a board appeal to the pupil. The pupil may test the time of the .25 second pendulum with the nine foot distance of fall of the ball. This pendulum, if released when the ball starts on its nine foot journey, will make three single swings and collide with the falling ball at the end of the third swing. If the height of the room permits, a seconds pendulum, or in terms of our unit of time a four fourths second pendulum may be used. This will be 39.37 inches long and the distance of fall will be sixteen feet.

THE completed board may be painted white with red or black lettering and figures upon it. It may then be mounted on the wall of the physics room as a permanent piece of equipment. It must be mounted so that it is plumb in both directions; it must be vertical. This project is a very effective means of teaching principles which are difficult to understand with more complicated equipment. This equipment is easily constructed and of such small cost that pupils can make *real* some of the fundamental principles in high school physics.

TEXAS JUNIOR ACADEMY

(Continued from page twenty-six)

tors. Miss Greta Oppe of the Ball High School is the present general chairman and Mr. Addison Lee of the Austin High School is secretary-treasurer. The presiding officer of this committee is appointed by the Executive Council of the Senior Academy. Each regional area has its own Junior officers who with the sponsoring committee take care of Junior activities in Texas.

Making Viscose and Rayon

DAVID SOIFER

Erasmus Hall High School — Brooklyn, New York

THE MAKING OF viscose and rayon can be done as experiment or a project. It is clean and neat and yields consistently excellent results.

Step 1.— Making ALKALI CELLULOSE

Into a small battery jar put about 15 filter paper circles cut a little smaller in diameter than the jar. Cover to the depth of 1 inch with 22-30% NaOH (For 30% NaOH dissolve 420 grams of NaOH in distilled water and dilute to 1 liter.) Cover with a glass plate and let stand for at least a week. As the circles are removed for step two replace them with other circles placed at the bottom of the pile. They may be permitted to soak indefinitely so that a supply is always on hand.

Step 2. — Pressing the ALKALI CELLULOSE

With tongs remove about 5 circles of the alkali cellulose and press between several sheets of mimeograph or other absorbent paper. Then (IMPORTANT!) separate the circles and press and pound each one individually between the absorbent paper, changing the absorbent sheets until all the excess NaOH has been expressed.

Step 3. — Making CELLULOSE XANTHATE

Put the alkali cellulose circles into a battery jar similar to the first, cover with an inch of carbon disulfide and then cover the jar with a glass pane. Let stand overnight.

Step 4. — Making VISCOSE

Remove the cellulose xanthate circles (which will have shrunk diametrically and thickened considerably) and expose to the air for about a minute to allow the excess carbon disulfide to evaporate, cut them up into pieces, put them into a large mouthed bottle and barely cover with a 2% NaOH. Let stand overnight and mix by stirring slowly.

Step 5. — Making RAYON

Fill up a rubber or glass syringe with the viscose and force the viscose through a glass capillary into dilute sulfuric acid (1 — 6). Have several capillaries on hand in case of clogging. Start the pressure on the viscose before it touches the acid so as not to plug the orifice of the apillary. With the fingers pull the thread of rayon slowly out of the acid. Have a beaker of sodium bicarbonate solution or ammonia water on hand for neutralizing acid on fingers.

N. B. — Please note that after a supply of the alkali cellulose is on hand, TWO days, at least, are necessary, — one night to form the cellulose xanthate and another night to dissolve it in water, although the last step can be completed in about an hour, or less if constant stirring is resorted to.

Do not attempt to preserve the viscose for more than 3 or 4 days as it will gel and syneresis will ensue.

Viscose stains on the fingers are easily removed with bromine water.

This experiment was shown at the "Annual Science Luncheon" of the New York Chemistry Teachers Association, Feb. 28, 1942.

AMERICAN COUNCIL

(Continued from page eleven)

branch of the service. Never have school administrators and interested laymen been more more willing to make science teaching more effective by making changes in the curriculum and other school adjustments. Never have science teachers been faced with such grave responsibilities in helping to determine what science teaching is most useful now and in the years to come. Can any one person without the counsel of others see the issues clearly to be sure of the solution? Let us counsel together through The American Council of Science Teachers.

A Unit on Weeds

MARTHA S. ENGEL*

Continued from April Issue

c. Weeds commonly found in waste lands. (1) Yarrow. Achillea millefolium L. Escaped cultviation. Sheep eat it. (2) Sow thistle. Sonchus arvensis L. Perennial and annual. Introduced from Europe. Has milky juice. Short rotation closely cultivated crops, smother or pasture. Figure X. (3) Butter and eggs, Toadflax or Wild Snapdragon. Linaria vulgaris Hill. Introduced from Europe. Spread by seeds and root stalks. Short rotation and frequent cultivation. (4) Beggars-tick or Stick-tight. Bidens frondosa L. Common on both hemispheres. Mow. Pull by hand. (5) Chicory or Succory. Cichorium Intybus L. Sometimes called Blue Sailors. Flowers bright

Fig. 10. Sow Thistle.

blue. Escaped cultivation. Introduced from Europe as food and to substitute for coffee. Mow to prevent seeds from maturing. Dig out roots. (6) Sand-burs. Cenchrus tribuloides L. Blooms June to October in sandy soil. Burs, if eaten by stock, produce inflammation. (7) Curled Dock. Rumex crispus L. Perennial with a deep tap root. Crop rotation and cultivation. Hand pull when the ground is wet. (8) Winged Pigweed. Tumble weed. Cycloloma atriplicifolium Spreng. Coult. The plant dries and breaks off at the ground line and rolls along in the wind. (9) Burdock. Arctium

Fig. 11. Burdock.

minus Bernh. or A. Lappa L. The burdock was introduced from Europe. The root was used in medicine. Seeds damage wool. Cut below crown at blooming time, cultivate and rotate crops. Figure XI.

d. Weeds found in pastures and meadows, and open woods. (1) Hawkweed. Hieracium aurantiacum L. A low perennial with orange to flame colored flowers. Introduced from Europe. Hand pull. Cultivate. (2) Catchfly. Silene antirrhina L. Pink flowers. Grows in sandy soil. Cultivate or hand pull. (3) Poison Ivy. Rhus toxicodendron L. Climbing or trailing shrub. Has three leaflets and white berries. Antidote is sugar of lead. Use good strong laundry soap to wash immediately after coming in contact with leaves. (4) Barberry. Berberis communus L. Harbors wheat rust. Dig out roots or kill with salt or other chemical. (5) Wild garlic. Allium vineale L. Naturalized from Europe. Gives a bad flavor to wheat flour and to dairy products. Crop rotation, close cultivation and oil sprays. (6) Common nettle Urtica gracilis Ait. A perennial herb with stinging hairs. Cultivation.

e. Weeds commonly found along roadsides. (1) Oxeye daisy, White weed, Summer Daisy, Poorland Flower, Poverty Weed. Chrysanthemum Leucanthermium L. A perennial reproducing from seeds and from offsets of the root stock. Short rotation and thorough cultivation. (2) Rag

* Senior High School, Madison, Wisconsin

weed. Ambrosia artemisiaefolia L. This plants relation to hay fever is generally known. Figure XII. (3) Bull thistle. Cirsium lanceolatum L. Hill. A perennial introduced from Europe. The heads are two to three inches long. Cultivation, digging up roots, pasturing and crop rotation. (4) Cockle bur. Xanthium canadense Mill. Poisonous to hogs. Spoils wheat flour. Hand pulling and cultivation. Figure XIII. (5) Wild Mustard. English Charlock. Brassica arvensis L. Introduced from Europe. The seeds are thrown some distance by splitting of the pods when ripe. Yellow fragrant flowers. Remarkable vitality of seeds. Sow clean seed, rotate with alfalfa and clover. Figure XIV. (6) Mullein, Velvet dock. Verbascum Thapsus L. Velvety leaves with spiked yellow flowers. Hand pull, cultivate. Sometimes called Pope's candle. (7) Canada thistle. Cirsium ar-

Fig. 12. Rag weed.

vense L. Introduced from Europe through Canada. Heads three-fourths to one inch long. Spreads by creeping root stalks. Smother, summer fallow or plant alfalfa. The last will certainly destroy the thistle. Figure XV. (8) Squirrel tail grass. Hordeum jubatum L. Sometimes called Wild Barley or Skunk Grass. Seeds are wind borne. The seeds work their way into the jaws and gums of stock and cause pus formation, inflammation and loss of teeth. Crop rotation. Figure XVI. (9) Sweet clover. White, Melilotus alba Des. Yellow, Melelotus officinalis. Introduced from Europe. Forage or honey plant. Presence of seed in grain gives flour an unpleasant odor. Somewhat poisonous. Mow, cultivate. (10) Russian thistle. Salsota Kali L. and varieties. Sometimes called Russian Cactus, or Russian Tumbleweed. Smooth or slightly hairy annual. One plant may produce 50,000 seeds. Breaks off at base and rolls over the prairies. Introduced from Russia. Pasture, especially sheep; rotation and cultivation. (11) Wild carrot. Daucus carota L. Known as Queen Anne's Lace,

Fig. 13. Cockle burs.

and Birdnest weed. This is the original plant from which cultivated carrots have been developed. Propagates by means of seeds. Mow and cultivate.

Suggested activities.

After collections or outdoor trips have been completed one may spend as little as one or two forty minute periods in class room work and study and still gain a workable knowledge of the weeds of the region. I generally spend a period and a half on study and discussion and a half a period on weed recognition tests. Usually some child will wish to carry on an individual project in connection with the work.

A. Collections.

1. Plants. Weed collections mounted and properly labeled serve as valuable material for school files for future study. Collections may be started and made on the general

Fig. 14. Mustard.

Fig. 15. Canada Thistle

class field trips or by the pupil individually. Fall is a good time for this study, since most of the weeds are bearing seed. A collection contest might be held to see which child can collect the largest number of varieties of weeds.

2. Seeds. These may be collected as indicated above. Seed collections illustrating the mechanisms of seed dispersal are interesting. Samples of seed crop seeds may be obtained and the kinds, and numbers of weed seeds present may be estimated and mounted for display.

B. Slides.

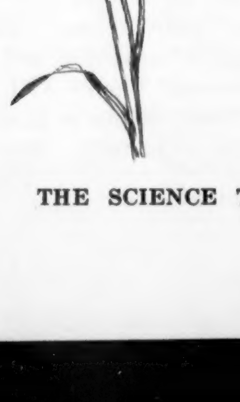
Simple slides may be made and kept for future reference and study by the following method. Clean slides and coverslips. Place a drop of Euparol on the slide. Drop the dry specimen into the Euparol. If the object is small, cover it with a cover slip and set the slide aside to dry. Be sure to label each slide at the time it is made. Such permanent mounts of pollen slides are still clear and distinct after five years. Suggestinos:

1. Pollen of weeds which are known to cause hay fever may be collected and mounts made for class demonstration.
2. Pollen of as many as possible of the common weeds may be collected and slides made to be used in units on flower study and pollenation.
3. Small seeds of weeds may be mounted and kept for reference for future years work. This collection may be added to each year and soon, with little effort, one has a fine teaching help.

C. Experimentation.

1. The vitality of weed seeds may be worked out as follows. Collect and weigh weed seeds. Heat them to various temperatures and test by germinating in wet blotting paper. Keep records carefully.
2. Rapidity of germination of weed seeds as compared with that of crop seeds may be worked out with germinating trays.

Fig. 16. Squirrel grass.



3. This is a good place to learn how to test seed germination.
4. Test crop seeds for purity. Mix the sample of seed thoroughly. Take a pinch here and there until you have a teaspoonful. Pour on a sheet of white paper and separate the good crop seed from the weed seeds, making two piles. Then separate the different weed seeds. If a manual on weed seeds is available, identify the weed seeds. An excellent reference is "Weeds of the Farm and Garden" by H. Pammell, Orange Judd Company, 1912.

D. Reference work. Look up Government pamphlets and library references on weeds. Look up the Weed and Seed Laws of the State.

E. Correlation with other school studies.
1. English; Themes on origin of weeds, a weed travelogue, importance of weeds, etc. Collection of poetry on weeds.
2. Art; Drawings of weeds and their seeds.

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PRE-FLIGHT AERONAUTICS

(Continued from page seventeen)

related to aeronautics. Aeronautics II offers the foundation of the principles of physics related to aeronautics. It should be understood that these short courses can be mastered only by boys, and girls, of normal mental ability, who are willing to work hard to make up their deficiencies in mathematics and physics.

6. *Guidance* School counselors should prescribe health examinations, consult records, give tests and advise the students as to their probable success in meeting the standards for airmen. Those who wish to enter the air force as mechanics, riggers, or maintenance men in ground crews should be directed to vocational schools or to after school classes in special shop work.

THE SUCCESS of the program in New York City and the dispatch with which it has been instituted is a fine example of what cooperation can do. City Superintendent John E. Wade, Asociate Supernitendent Frederic Ernst, in charge of academic high schools, and Associate Superintendent George F. Pigott, in charge of vocational schools, have taken the leadership in the program and have met an enthusiastic response on the part of the teachers.

It is too early to predict how many students will enroll in the courses. While the program of pre-flight training was instituted primarily for boys, nevertheless girls will be admitted to all courses on the same terms as the boys. This policy is based on the expressed desire by the principals of girls high schools to participate and upon the demonstrated fact that girls not only make good pilots but can take the place of men when the latter are called to the armed forces.

THAT changes in the courses will be made as a result of further experience is to be expected. The real test is whether or not the boys who receive this training are able to meet the qualifying tests of the Army and

Navy, and whether or not the job of making pilots is to any degree made easier or shortened. Aeronautics as a field of study in high schools is doubtless here to stay. The war emergency demands it now, and fast developing air-mindedness of America will see that it remains after victory is won.

AVIATION IN HIGH SCHOOL

(Continued from page fourteen)

Foreign languages likewise provide opportunities for aviation education. For many years an active airway trade has flourished between theh United States and South America. The requirements of military transport have developed planes which, after the war, will bring other nations even closer to our shores. While the student is learning Spanish or any other modern language, the topics can as easily — and more fruitfully — be slanted toward aviation as any other field.

The Task Ahead

THE United States Government has charged the school system and its educators with the responsibility of interesting the nation's youth in aviation, and has requested that aviation courses be introduced to provide future flying cadets with as much pre-flight training as possible.

Traditional attitudes and concepts must be laid aside, lest today's "education as usual" may become tomorrow's "too little too late." The years that educators normally spend in preparing to teach a new subject must be shortened to the weeks at hand. Formal presentation must give way to lively understanding of the ever-new, ever-changing developments in the world of the air. Teachers and students together must reject their earthbound heritage.

Let our schools adopt the slogan — "The difficult things we do today, the impossible tomorrow."

Can you qualify as a Junior Engineer under civil service? (See page 48.) Your country needs you.

ARTERIAL INJECTIONS

(Continued from page twenty-seven)

of a toad dissected away from the body as completely as possible, and mounted on rubber-cemented paper between two sheets of glass. All of these injections and dissections have been given to the biological science department of Austin High School for use by classes studying circulation.

SIX DIFFERENT injection masses were used. The gelatine-glycerine mass contains gelatine, glycerine, and water. The gelatine mass contains gelatine, water, and lead acetate and potasium bichromate. Two casein glue masses were used. One, for which the formula was given me, contains casein glue, gelatine, glycerine, tannic acid, glucose, and water. The other, which I made myself, is composed of casein glue, gelatine, glycerine, and water. Another mass, cornstarch, contains cornstarch, glycerine, formalin, and water. A commercial latex preparation was the only mass purchased. In an attempt to imitate the commercial mass, I prepared a mass composed of ordinary latex dissolved in ammonium hydroxide, and colored with carmine. This I called Dyess latex.

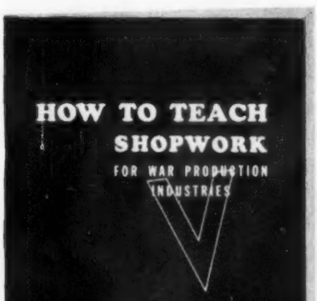
IN DISSECTING the animals, appearance, toughness, and elasticity of the masses in the arteries were noted. Both gelatine preparations were somewhat soft and easily torn, but more flexible than the glue or cornstarch mases. The rapid hardening of the cornstarch and casein mixtures made it difficult to complete an injection. Arteries injected with either were easily torn. The two casein glue mixtures differed little in the final results. The cornstarch and glue masses had to be used immediately after mixing, while the gelatine masses could be allowed to set, and then melted when needed. The two latex masses were the best used. They appear very smooth and bright in the arteries, and they were the only masses tried which were very tough and elastic. Much time is saved by using latex, since it travels through the arteries rapidly, and spreads into very minute vessels. Although my latex mixture took

longer to harden, it exhibited no tendency to backflow, and was equally as good as the commercial preparation.

Lead chromate was the best color used in the masses, since it appeared bright in the arteries, and did not diffuse into the tissues, while carmine and methylene blue did.

FIGURED on the basis of one pint, the costs of the masses were 25c for gelatine-glycerine, 25c for gelatine, 18c for cornstarch, 13c for casein glue, 93c for commercially prepared latex, and 40c for Dyess latex. The cost is really not important, however, when the value as an injection mass is considered. A pint of latex, although it is the most expensive, lasts longer than the same amount of any other mass.

In rating the masses used as to their desireability, they would be listed in the following order: 1) Commercially prepared latex and Dyess latex; 2) Gelatine-glycerine; 3) Gelatine; 4) Cornstarch; 5) Casein glue.



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NELSON CELL

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some, for if the salt brine had produced sodium hydroxide and chlorine, there would have to be some hydrogen.

On my second attempt, I punched a number of pinholes in the diaphragm. When I tried it out this time, I found that the brine came through the pinholes so fast that no reaction took place at all. It was very obvious that I had used both extremes and would now have to strike a medium where the brine would flow through neither too slowly nor too fast.

ON MY third attempt, I installed a new diaphragm. This, I scratched on the inner side so that it was only about half its original thickness. I also got another glass container which did not have any cracks through which the hydrogen could escape. This time the cell worked very satisfactorily. At first the sodium hydroxide contained a heavy, green material which tested as iron hydroxide, but after the cell had operated a while, this green material was not coming off the cathode so abundantly. Therefore, I am inclined to believe that this impurity may be greatly cut down, and perhaps done away with after the cell has been in operation for a longer period of time.

The idea of having a trap in the salt brine duct proved not to be good, because the chlorine had enough pressure to force the liquid out of the trap. I had to stop up the intake, except when refilling the cell, to prevent chlorine from escaping.

THE CELL operates on eight volts, direct current, and draws about five and one-half amperes. In our laboratory, this is furnished by a rectifier.

The operation of the cell is as follows: salt brine is fed into the inner container and is let out slowly through the asbestos diaphragm, which acts as the side of the container. When the brine comes in contact with the cathode outside the diaphragm, the brine is ionized and the chlorine is attracted to the carbon anode in the center of the inner cell while the hydrogen and sodium go to the steel cathode and are separated

ASSOCIATION PROGRAMS

(Continued from page twenty-three)

E. Other topics which teachers would like discussed are:

1. New courses of study
2. How to develop scientific thinking
3. Student activities and projects
4. Making science functional to the personal, social, and community needs
5. Science for the non-academic students
6. Science for consumer education
7. A science sequence
8. Conservation education
9. Construction of better tests
10. The evaluation of science and its place in education

F. In line with the more important needs of teachers in service greater attention should also be given in association programs to the problems of:

1. How to organize the content and methods of science to achieve the aims and objectives
2. The development of warm-hearted, sympathetic personalities
3. How to increase the teacher's broad, general background, beyond science*
4. The evaluation of pupils' work in terms of objectives
5. How to organize combinations of methods for different units and student groups
6. How to understand child and adolescent psychology, their drives and interests
7. Skill in questioning and discussing
8. Skill in using various methods
9. Skill in using visual aids as a coordinated part of the teaching process
10. Pupil determination and solution of their own problems involving science in science classes
11. Health education
12. Co-ordination between science and other subjects in the secondary curriculum
13. Students entering secondary science classes with low mental ability

G. Also, in line with needs of teachers in service, programs should continue to give important consideration to the problems of:

1. How to develop a science sequence from grades one to twelve or fourteen
2. Understanding of the aims of science education in relation to the aims of general education
3. Locating, procuring, and making visual aids
4. Consumer education
5. Safety education
6. Knowledge and understanding of the aims of general education
7. The reorganization and integration of specialized science, formerly taken, to meet secondary science needs
8. Non - college - preparatory secondary science courses
9. Developing an understanding of scientific principles and generalizations
10. Knowledge of the latest developments in fields of scientific research.
11. Konwledge of various methods
12. Less emphasis on facts to be memorized as an end to themselves
13. Sex education
14. Knowledge of new and striking demonstrations
15. Organizing and conducting science clubs
16. Organizing and conducting museum, industrial, and nature field trips
17. Integration within secondary science tending to erase sharp demarcation lines between biology, physics, and chemistry
18. Applied science courses for secondary vocational curricula
19. Knowledge of the specialized sciences
20. Using supplemental reading as a coordinated part of the teaching process
21. Manipulative techniques with laboratory apparatus

* At least attention can be called to the importance of these needs.

22. Physical science courses for the upper grades (unified)
23. Skill in using radio and recordings, and co-ordinating them with science teaching
24. The use and evaluation of notebooks, or workbooks
25. How to use and demonstrate the newer apparatus of research in the fields of science
26. Generalized courses
27. More demonstrations and less pupil laboratory work

H. Teachers favor separate subject section meetings, rather than having all science teachers together, but many see the advantages of both. They are less interested in meeting with teachers of a related subject.

I. Informal conferences centered about previously selected topics rate fourth as a favorite type of program. Teachers are less willing to take a chance on topics that might be proposed spontaneously at the time of the meeting.

Regardless of what is actually needed most by science teachers already in service, association programs seem particularly well adapted for the types of programs previously mentioned in "A" and "B." I must repeat that problems of civilian and national defense were not as important when this study was made as they are now and should probably be inserted in this list.

ANOTHER TYPE of meeting which the study did not consider and which the writer now wishes to emphasize without sufficient objective data is the importance of joint meetings of science teachers with administrators. Science teachers must pay more respectful attention to broad trends in education. If they don't bend they may be broken. Lets do a little streamlining on our courses and see to it that it comes to the attention of the administrators. Take them as guests to a dinner meeting and let a respected administrator that has the right perspective on science education tell his fellow administrators what we as science teachers would like to tell them.

A National Membership in **American Council of Science Teachers**

A Department of the National Education Association

Aelfric James, Treasurer
801 Spring Garden St.
Easton, Pennsylvania

I desire to become a member of (or renew my membership in) the American Council of Science Teachers and am enclosing $1.00 is payment of dues.

As a member, I understand that I am to receive the following: (1) *The Science Teacher*, the official journal of the association, published quarterly; (2) The yearbook of the association, published annually; (3) All other materials and services provided its members.

Please rebate part of my dues to:..
(Write name of your local, regional, or national affiliated group here.)

NAME .... SCHOOL ADDRESS ....
Street

SCHOOL ....
City State

A National Membership in **American Science Teachers Association**

Associated with the American Association for the Advancement of Science

Deborah M. Russell, Secretary
State Teachers College, Framinghom, Massachusetts

I desire to become a direct member of (or renew my membership in) the American Science Teachers Association and am enclosing $1.00 in payment of dues.

As a member I understand that I am to receive the following: (1) *The Science Teacher*, the official journal of the association; 2) Reports of association work and other information sent to members of the association; (3) Privilege of attending all the meetings of the association and participating in its work.

NAME .... SCHOOL ADDRESS ....
Street

SCHOOL ....
City State

AIR CORPS WANTS ENGINEERS

The U. S. army air corps at Wright Field, Dayton, Ohio, has just issued their *second* appeal for junior engineers in the mechanical, electrical and aeronautical fields. Their need is very urgent.

Openings are available for immediate appointment at $2400 per annum. Graduate engineers with no experience as well as those physically handicapped may qualify.

Here is an opportunity to gain invaluable experience by working at the air corps nerve center on tomorrow's planes today—and help your country at the same time.

For further information, get in touch with the Recruiting Section, Seventh U. S. Civil Service Region, Room 1107, New Post Office Building, Chicago, Illinois.

STATEMENT OF THE OWNERSHIP, MANAGEMENT, CIRCULATION, ETC., REQUIRED BY THE ACTS OF CONGRESS OF AUGUST 24, 1912, AND MARCH 3, 1933

Of *The Science Teacher*, published 4 times per year at Normal, Illinois, for October, 1941.

STATE OF ILLINOIS, County of McLean, ss.

Before me, a notary public in and for the State and county aforesaid, personally appeared John C. Chiddix, who, having been duly sworn according to law, deposes and says that he is the owner of *The Science Teacher* and that the following is, to the best of his knowledge and belief, a true statement of the ownership, management, etc., of the aforesaid publication for the date shown in the above caption, required by the Act of August 24, 1912, as amended by the Act of March 3, 1933, embodied in section 537, Postal Laws and Regulations, printed on the reverse of this form, to-wit:

1. That the names and addresses of the publisher, editor, managing editor, and business managers are:
Publisher—John C. Chiddix, Normal, Illinois.
Editor—John C. Chiddix, Normal, Illinois.
Managing Editor—None.
Business Manager—John C. Chiddix, Normal, Illinois.

2. That the owner is: John C. Chiddix.

3. That the known bondholders, mortgagees, and other security holders owning or holding 1 per cent of total amount of bonds, mortgages, or other securities are: none.

JOHN C. CHIDDIX.

Sworn to and subscribed before me this 28th day of September, 1942.

Ethel Pace.

(SEAL) (My commission expires, Jan. 18, 1943.)